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THE EFFECTIVENESS OF TEACHING READING IN KINDERGARTEN.
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*KINDERGARTEN CHILDREN, *READING INSTRUCTION, *READING ACHIEVEMENT, *READING COMPREHENSION, *READING DEVELOPMENT, READING RESEARCH, READING SKILLS, ELEMENTARY SCHOOLS, READING ABILITY, READING LEVELS, DENVER, COLORADO

THIS STUDY INVESTIGATED THE EFFECTIVENESS OF BEGINNING THE TEACHING OF READING IN KINDERGARTEN. THE LONGITUDINAL EFFECTS AS WELL AS THE INITIAL RESULTS WERE EXAMINED. THE PROGRESS OF THE CHILDREN IN THE STUDY WAS FOLLOWED FROM THE KINDERGARTEN THROUGH THE FIFTH GRADE. THE SAMPLE CONSISTED OF 4,000 KINDERGARTEN PUPILS RANDOMLY ASSIGNED BY THE SCHOOL TO COMPARABLE CONTROL AND EXPERIMENTAL GROUPS. INSTRUCTIONS WERE SIMILAR EXCEPT FOR ONE MAJOR DIFFERENCE. THE EXPERIMENTAL GROUP RECEIVED PLANNED, SEQUENTIAL INSTRUCTION IN BEGINNING READING, WHILE THE CONTROL GROUP HAD ACTIVITIES WHICH DEVELOPED READING READINESS. THE PRINCIPAL STATISTICAL TECHNIQUE WAS ANALYSIS OF VARIANCE-COVARIANCE TECHNIQUE. THE PRIMARY VARIABLE CONSIDERED WAS THE TIME OF BEGINNING READING. OTHER VARIABLES WERE MENTAL AGE, CHRONOLOGICAL AGE, SEX, IQ, AND FAMILY CHARACTERISTICS. THESE LATTER VARIABLES WERE ALSO USED AS COVARIATES. COMPARISONS WERE MADE ON THE CRITERION VARIABLE (READING ACHIEVEMENT) BETWEEN EXPERIMENTAL AND CONTROL GROUPS AND EFFECTS OF OTHER VARIABLES WERE STUDIED IN THE SAME WAY. ANALYSIS OF VARIANCE ALLOWED COMPUTATION OF THE INTERACTION BETWEEN VARIABLES. IN EVERY CASE, ATTENTION WAS GIVEN TO THE INTERACTION OF THE TREATMENT VARIABLE (TIME OF BEGINNING READING) WITH THE OTHER VARIABLES IN DETERMINING THE EFFECT OF THE CRITERION VARIABLE (READING ACHIEVEMENT). OPTIMUM READING ACHIEVEMENT WAS OBTAINED BY BOYS AND GIRLS WHO RECEIVED THE EXPERIMENTAL BEGINNING READING INSTRUCTION IN KINDERGARTEN AND WHO HAD AN ADJUSTED READING PROGRAM IN LATER GRADES. SUCH ADJUSTMENT WAS NECESSARY FOR THE MEASURABLE ADVANTAGES OF EARLY READING INSTRUCTION TO BE PRESERVED BEYOND THE SECOND GRADE. WHEN THE ADVANTAGES OF AN EARLY START IN READING WERE FOLLOWED UP, STATISTICALLY SIGNIFICANT GAINS IN READING ACHIEVEMENT PERSISTED THROUGHOUT THE ENTIRE STUDY. (GC)

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THE EFFECTIVENESS of TEACHING READING IN KINDERGARTEN

Cooperative Research Project No. 5-0371

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Denver, Colorado
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PREFACE

The work of many people contributed to the longitudinal study of reading in kindergarten. The leadership of Kenneth E. Oberholtzer, Superintendent of the Denver Public Schools, created an educational climate which made possible the initiation of the project. The counsel and advice of Roy A. Hinderman and Lloid B. Jones aided in its implementation. Byron W. Hansford, Colorado State Commissioner of Education, materially supported and encouraged the study. Paul McKee and Lucile Harrison provided the detailed program of instruction which constituted the experimental methodology.

However, in the final analysis, the project was made possible only by the informed and cooperative efforts of certain professional colleagues, teachers, principals, school board members, pupils, and members of the local Parent-Teacher Association. It is for these individuals that this report was written. The aim was to prepare a narrative that someone other than research specialists could understand. For this reason, technical terminology has been avoided and much of the statistical detail, of interest primarily to educational researchers, placed in the appendices.

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A STUDY OF THE EFFECTIVENESS OF BEGINNING THE TEACHING OF READING IN KINDERGARTEN

"Everything changes. For everything that exists is the seed of that which shall come out of it."

Marcus Aurelius

Chapter I

FORCES FOR CHANGE

In the fall of 1960, the Denver Public Schools, with the aid of a grant from the Cooperative Research Branch of the United States Office of Education, under the provisions of Public Law 531, began a research project to determine the effectiveness of beginning the systematic teaching of reading in kindergarten. The research analyzed the progress of pupils from kindergarten through the fifth grade. This is a report of the findings.

The Reappraisal of Educational Practices

When the preliminary planning for the project started, the searching reappraisal of educational practice was in its initial stages. A nation, jolted by Sputnik I and threatened by the forces of world communism, became extremely apprehensive regarding the quality of American education. Demands were heard that the future of America requires an educational system devoted to no less than the pursuit of excellence.[1]

A presidential commission, emphasizing the need for innovation and re-examination of existing practices, observed that, "All the methods and procedures that characterize American education today were originally devised to help us accomplish our purposes. If they no longer help us, we must revise them. The arrangements and methods must serve us and not control us. We would be in a better position to appraise the validity of present method and the promise of new ones if we enjoyed a more vigorous tradition of research in education. The sooner we remedy this lack, the better. In seeking the most effective ways of accomplishing our educational purposes, we are going to have to take a flexible and experimental view of various established practices."[2]

Many traditionalists disagreed. Satisfied with familiar instructional procedures, they were reluctant to modify them. Doubting the worth of new methods, they were hesitant to test them. Nevertheless, pressures for change and a widespread recognition that instruction could be made more effective led to the still-continuing revolution in American education--a period characterized by innovation and experimentation.

The Explosion of Knowledge and Children's Environment

The American way of life is becoming more complex, more exacting, more demanding of knowledge and skill. Mankind's store of knowledge is increasing at a phenomenal rate. There is more to be learned by pupils in the schools. This explosion of knowledge and our expanding technology is not without its benefits.

Consideration of the environment in which children live shows their experiences to be broader than those of youngsters in the past. Before entering kindergarten today, children are exposed to a great many educational stimuli. Many have attended nursery schools for one, two, or more years. Even in deprived homes, television, with all the experiences it provides, has been part of children's lives from their earliest memories. These children also live in an era of relative mobility. Many have traveled widely within their own country, and some have visited other lands. Children are no longer reared according to the maxim that they "should be seen and not heard." They may participate more than ever before in family life and share in adult conversation and ideas. As a result of technological advances, they live in a world of words, seeing them in books, magazines, newspapers, in advertisements, and on signs. It has been estimated that their listening and speaking vocabulary contains 5,000 to 10,000 or more words. Studies confirm that boys and girls today possess far higher levels of language development than did their counterparts of a generation ago. [3]

"Certainly a greater degree of preparedness for learning on the part of some boys and girls appears to be present. Some of them can read when they enter kindergarten." [4] The issue arises as to what should be the goals of kindergarten education.

Re-examination of Kindergarten Goals

Changing conditions within a society, technological discoveries, and new insights into the learning process influence educational practice. As the rate of change increases and instructional procedures show signs of stress and strain in meeting the challenge, educational innovation is encouraged. Generally accepted beliefs are re-examined and modified. New ideas and methods are tried in an effort to increase educational efficiency.

Currently, the field of early childhood education is experiencing this process. This is not surprising. While educational innovation and experimentation have had profound influence upon other levels, kindergarten education has remained relatively unchanged--although few would argue that no improvements are needed. Indeed, there are many suggestions that balance needs to be restored to the kindergarten curriculum, that the play experiences designed to promote personal and social development should be accompanied by content which strengthens the intellectual climate of the kindergarten.

The dilemma facing kindergarten teachers is quite real. The quotations which follow serve to define it.

"Are kindergartens obsolete?" Spodek and Robison ask. "The kindergartens developed in the nineteenth century to foster the child's intellectual growth. There is growing doubt that the kindergartens of the twentieth century are equipped for this task. . . (as) "The climate of the kindergarten became more democratic and child centered in the 1940's and 1950's, the 'child development point of view' became the watchword of the kindergartens. Unfortunately, in too many schools the better the social climate became, the more sterile its intellectual content and climate became. During these years, some kindergarten teachers misunderstood and misapplied the child development point of view. Afraid of frustrating the child, teachers refrained from offering challenge. . . afraid of inhibiting the child, teachers withheld their help or guidance in the development of needed skills. Thus, the kindergarten programs. . . moved further from the objective of fostering children's intellectual growth. The resulting dissatisfaction has brought demands for the return of challenging content to the kindergarten." [5]

Those who would heed this criticism and endeavor to provide for children's intellectual growth in the kindergarten encounter the admonitions of specialists in early childhood education that, "The opportunity to have social contacts with children of similar age is the best reason for the existence of nursery schools and kindergartens." [6]

Those holding this point of view concede that skills are important but, "They doubt that most young children are sufficiently mature physically and emotionally to withstand systematic teaching without harmful results. . . They believe that childhood has its own values and needs. . ." [7] "The kindergarten is designed for five-year-olds. Its central purpose is to help the young child adapt to school, to find his place in school life and the group of which he is a member, and to promote readiness for learning in various areas." [8] "From the research which is pertinent, the studies and observations of five-year-olds in a learning association, and the evidence of the later effect of early learning. . . it would seem that the very young and particularly the relatively immature five-year-old would best profit from concept development and listening and speaking development in a comparatively unstructured environment." [9]

These then, are the dimensions of the problem. New answers are being sought for the question as to what kindergartens are for. It appears likely that the relatively unstructured play experiences designed to promote personal and social development will come to be accompanied by content which improves the intellectual climate of the kindergarten. Evidence that this will occur can be seen in recent developments. Proponents of informal rather loosely defined kindergarten programs argue that there long has been an academic content in the kindergarten. Those in favor of carefully structured kindergarten experiences designed to achieve more clearly defined objectives express agreement that this should be the case. Thus, there are signs of emerging agreement.

The real questions seem to revolve about how this can best be accomplished; how a balance can be achieved between the development of children's personal-social skills and the awakening of their intellectual abilities. It seems reasonable to suggest that these goals need not be thought of as being antithetical. What appeared to be required was research as to how this might be done. Evidence was needed showing immediate and long range effects.

Because of the magnitude of the problem and because "reading or interest in reading is already a part of the lives of many five-year-olds,"[10] it was decided to limit the investigation to the effectiveness of beginning the teaching of reading in the kindergarten.

Advances in Psychological Theory

Educational theory is influenced, either consciously or unconsciously, by the psychological viewpoints upon which it is based. For a number of years school practice in the area of early childhood and kindergarten education was dominated by maturational psychologists who advocated postponing and delaying instruction until the child is "ready".

This maturational psychology, based upon the belief that learning is dependent upon innate growth processes which unfold as the child grows chronologically older, arises from the well-publicized work of Gesell and others.[11] In practice it tended to restrict educational effort. Adherents of this school of psychology emphasized the importance of delaying instruction until the pupil has reached the age at which they felt the necessary physiological maturity would occur. To try to teach earlier would be a waste of time or perhaps, even dangerous.

So influential was this point of view that schools in general did little to investigate the possibilities inherent in early stimulation or training--in spite of the widely recognized efforts of cultural deprivation upon learning. "It has long been known that a general relationship exists between environmental deprivation and learning. The large body of empirical literature supports the assumption that certain conditions may retard psychological processes including intellectual development. This conclusion is borne out by research on both animals and humans."[12] Yet, for a number of years educators were somewhat reluctant to consider the potential in an enriched environmental situation. In the current decade however, educational psychologists and theorists have begun to emphasize the effect of environment upon learning, contending as does Hunt, "In light of these theoretical considerations and the evidence concerning the effects of early experience . . . it is no longer unreasonable to consider that it might be feasible to discover ways to govern the encounters that children have with their environments, especially during the early years of their development, to achieve a substantially faster rate of intellectual development. . . moreover. . . promoting intellectual development properly need imply nothing like the grim urgency which has been associated with pushing children." [13]

There is increasing support for the position that if young children are appropriately challenged and stimulated, early intellectual growth may result. A theoretical basis for this belief can be found in the writing of several psychologists. "Many students of human development have noted that there is a phenomenon by which supply creates demand. Gordon Allport has written of the functional autonomy of motives, the sequence whereby a habitual activity seems to acquire a motive of its own for its continuation. Karl Buhler, commenting on the development of language in children, has, you will recall, proposed the concept of Funktionslust--pleasure derived from the exercise of a newly developed function or skill. Donald Hebb and Robert White more recently have suggested that there seems to be an intrinsic pleasure or self-reward in gaining competence that feeds upon itself in the sense that the development of taste leads to increasing development of taste. How important this is in cultivating a taste for discovering we have already seen." [14] A practical outcome of this viewpoint has been to shift the emphasis from waiting for readiness to striving to develop it. Readiness becomes "a function not so much of maturation as it is of our intentions and our skill at translating ideas into the language and concepts of the age levels we are teaching." [15]

Bruner, perhaps the most influential spokesman for the idea that "one teaches readiness or provides opportunities for its nurture; one does not simply wait for it," [16] suggests that readiness, "consists of mastery of those simpler skills that permit one to reach higher skills." [17]

Educators, adapting this point of view, have the responsibility for action thrust upon them. The danger becomes not one of doing but of waiting, "for it may well be that early sensory and intellectual deprivation prevents the kind of intellectual and emotional unfolding that nourishes early learning and makes later learning possible." [18]

Advances in Educational Methodology

Methods and materials of instruction undergo frequent modification in an effort to improve them. Sound instructional methodology and appropriate materials of instruction are basic requirements for successful educational innovations. Improvements in methodology and material are often the result of competence achieved through long experience. Over the years, new insights are gained which may make possible that which was previously unattainable. This was the case with two of the nation's leading reading authorities, Paul McKee and M. Lucile Harrison, professors of education at Colorado State College, former directors of the college reading center, authors of many professional books on the teaching of reading, and co-editors of a widely used basal reading series produced by a major publishing company.

Through a lifetime of working with boys and girls and developing reading materials for them, Paul McKee and Lucile Harrison evolved an approach to the teaching of reading that built upon the oral language skills children cultivated as they learned to speak and to listen. Using this natural approach as the means of instruction, they felt that children perhaps could learn to read successfully at an early age. In view of the experience possessed by McKee and Harrison, this possibility seemed worthy of exploration.

The School and the Community

The nature and quality of education within a community is dependent upon several closely related factors. . . the expectations of the populace, the support provided through their elected representatives on the school board, the professional ability of the teaching staff, and the instructional leadership given by the administrative staff.

When the study began, the Denver Public Schools was a system serving approximately 90,000 pupils with about 3,500 teachers. Approximately 9,000 children were enrolled in kindergarten. Throughout the period of the study, Denver continued to grow and expand. The class exodus to the suburbs was minimized through annexations. The educational aspirations of the people of Denver remained quite high. The local school board reflected this interest by encouraging a constant striving for improved education for the boys and girls. As a result of the administrative leadership provided by the superintendent of schools, his deputy, and the professional instructional staff, the Denver Public Schools had a great deal of research experience. Numerous experimental studies of varying degrees of depth and magnitude caused the community to become research oriented. The Parent-Teacher Association actively supported educational experimentation. The schools and the community at large believed firmly in the philosophy that curriculum change must be on-going and must be based upon sound trial and careful evaluation of results.

Summary

In the fall of 1960, the Denver Public Schools began a longitudinal investigation to determine the effectiveness of beginning the teaching of reading in the kindergarten. This study followed a group of pupils from kindergarten through fifth grade. There were a number of reasons for initiating a study of the effectiveness of beginning the teaching of reading in the kindergarten.

The American people are committed to excellence in education. They recognize that what was good education for their forebears might not be good enough for their children.

The explosion of knowledge and its concomitant influence upon children's environment may have produced a preparedness for learning at early ages.

These conditions motivated a re-examination of the role of the kindergarten with greater concern for the program's contribution to the mental development of children.

Advances in psychology of learning have focused attention on the possibilities of early educational stimulation.

New instructional methods and materials suggest the feasibility of beginning the systematic teaching of reading in the kindergarten.

The educational leadership and the expectations of the community created a climate which encouraged trial of new approaches--a searching for improved educational practices.

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Chapter II

NATURE OF THE STUDY

Developing the ability to read well is an important educational objective. It is one of the major tasks of schools today. Mankind's store of knowledge is preserved and communicated through the written word. Current world conditions require the learning of an unprecedented amount of complex information, much of which must be obtained through reading. Effective reading is a prerequisite to efficient use of knowledge and a key to academic success. The reading of printed material is one of the most convenient and rapid means of securing information. It is a process by which ideas may be re-examined at a pace suited to the learner's requirements. "No skill in education is more fundamental than reading. It remains the chief means by which anyone can continue his education independently long after his school days have passed. It is to be expected therefore, that all concerned would urge early acquisition of this skill. The issue thus arises as to when organized instruction in reading should begin." [1]

In recent years probably no subject in the elementary school curriculum has been the focus of as much attention as that of beginning reading. Traditionally, in the United States systematic teaching of reading has been started in the first grade. In part, the reason is that in much of the country there is no provision for schooling before age six. Another reason is that generally, this has been thought to be the best age. However, research on the teaching of reading shows that children can learn to read at an earlier time. Reports from other nations indicate children are taught to read at earlier ages than is usually the case in this country. Increasing numbers of children are able to do a little reading at the time they enter the first grade. Thus the question naturally arose as to how effective would be the teaching of reading in the kindergarten and as to how worthwhile it would be to begin the teaching of reading in the kindergarten.

PURPOSE

It was out of the foregoing considerations that the research project was designed to examine specifically the effectiveness of beginning the teaching of reading in the kindergarten.

The data to be gathered would:

(1) Indicate not only the immediate results of beginning teaching of reading in the kindergarten but also the achievement made during each of several years, and

(2) Show any effects related to such reading instruction, whether harmful or beneficial.

RELATED RESEARCH

An early step in the study was to review related research. A great many reports were found to be available and were examined as indicated in the following sections. The findings were not conclusive.

Age for Beginning to Read

The data did not seem to establish any one mental age as requisite for success in beginning reading. Indications as to the mental age at which children can successfully be taught beginning reading ranged from below three years reported by Moore [2] and four years by Davidson [3] to six years and six months reported by Morphett and Washburne[4], and Bigelow. [5] Correlations between reading achievement and mental age ranged from .25 reported by Gates and Bond [6] to a high of .62 reported by Dean. [7]

In Scotland children are regularly introduced to reading at the age of five. Conclusions concerning the results of such instruction are conflicting. Some studies indicate that the Scottish children read significantly better than their American and English counterparts. [8] Others, including a study by Vernon, O'Gorman, and McClellan [9], suggest that Scottish children taught at the age of five read no better at later ages than children taught at the age of six.

Delaying as an Instructional Method

One of the earliest reports suggesting that reading instruction be delayed can be traced to Professor G.T.W. Patrick of the University of Iowa, who proposed in 1896 that reading not be taught until children were ten years old. [10] Perhaps the most influential study in establishing the concept of delay as an instructional technique was that of Morphett and Washburne [11] who reported in 1931 that failure in reading among first grade children in Winnetka, Illinois decreased as children approached the mental age of six-and-one-half years. Above that point, most succeeded in learning to read. This seems to have been a valid conclusion for the time, the methods and materials employed by Morphett and Washburne. This finding, coupled with the usual entrance age of children into the first grade, tended through the years to reinforce the idea that reading should be postponed until children reached a mental age of about six-and-one-half years. It did much to establish "delaying" as an educational practice

Dearborn and Anderson refer to this process of postponing reading until the children are older and mentally more mature as a delaying method to distinguish it from pacing--which implies that the school program is adapted to the individual ability of children. Pacing may result in delay for some children but not for others. Delaying implies postponing the introduction of a subject or a skill until a later time, which may, in turn, exclude some children from the experience when they already possess the necessary aptitude. The idea behind the delaying method is that more of the children will succeed at the task when they are older. [12]

One of the most interesting studies in this regard has been conducted by Gates. Studying four different groups of first grade children taught by different methods and materials, he found that the mental age required to read ranged from five years in one group to five years and five months in the second, to six years in the third, to six years and five months and above in the fourth group. Gates concluded that statements which set a minimum mental age as necessary for success in beginning reading apart from the methods and materials of instruction are "essentially meaningless." [13] The age when children can best begin to learn to read with one instructional program or a certain method used by an individual teacher may differ greatly under other conditions of instruction.

Influence of Methodology Upon Beginning Reading Age

The position suggested by Gates is supported by several other researchers. Many factors influence the age at which it is possible to teach beginning reading. Two of the most important are the methods and materials of instruction which are used. A study conducted by Gates and Bond [14] showed that there appeared to be no mental age below which few children fail and above which most succeed in learning to read. Rather, they hypothesized that the methods and materials of instruction can be adjusted to teach children successfully at the time reading has value to them.

Several other studies support this belief. Roslow [15] reported that children with a mental age below six years could be taught to read successfully when the instructional materials and techniques were planned in accordance with their needs.

Keister, [16] studying three groups of children whose ages ranged from four years and six months to six years and eleven months, found that five-year-old children could be taught to read when the reading program was modified to meet their specific needs and interest.

A sound conclusion appears to be one voiced by Russell that, "In other words, the important thing is not the mental age of the child but the quality of teaching and instructional materials, especially with reference to their adaptation to the needs of the individual child." [17]

Visual Discrimination and Auditory Perception

Some studies, based upon observation of children, suggest that young children are deficient in visual discrimination [18, 19] and auditory perception. [20] Again, the evidence is somewhat contradictory. Other investigators [21, 22] indicate that specific training can overcome these apparent limitations. Analysis of the data seems to show that, although children may have visual or auditory defects, it is not possible to predict success or failure in reading on the basis of these defects. Parenthetically, recent research is reasuring.

Ilg,[23] while voicing caution concerning immature vision, indicates that it is fairly common for most boys and girls to begin perceiving letters at three or four years of age. Eames, [24] of the Harvard Psycho-Educational clinic, found that children at five years of age have more accommodative visual power than at any age thereafter. The poorest visual acuity he reported was sufficient for reading the usual texts.

Studies Reporting Early Reading

A relationship between environmental factors and linguistic achievement has been established by research. Authorities generally accept the results of investigations of the effects of a childhood lacking in opportunities for language development. Studies of young children raised in institutions such as orphanages tend to show the detrimental influence upon youngsters of a childhood with meager opportunities for language growth.

Equal recognition is not always accorded research which appears to suggest that a childhood characterized by richness of experience may offer excellent possibilities for further development. Several studies suggest that a period of waiting or of inactivity is to be avoided. Evidence from these studies supports a program of positive action to provide for appropriate beginning reading experiences.

Research indicates that the best readers and the first to learn to read are usually those children who know the most letter forms and sounds.[25] Almy concluded that, "A significant, positive relationship exists between success in beginning reading and the child's opportunities for reading prior to the first grade. . . While the experiences which are usually thought of as 'reading', such as looking at books and magazines or being read to contribute to the positive relationship between reading success and responses to opportunities for reading, interest in words, letters, numbers, wherever they may be found, are also important factors in the relationship."[26]

Similarly, Durkin,[27] studying children who came to school able to read, found significant factors to be the attitude of the family toward reading and the presence of someone in the home--relative, parent, or sibling--who satisfied the child's curiosity about reading and helped him to read.

In summary, available evidence appeared to support the following points of view:

1. No one mental age guaranteed beginning reading success. Equally important were the methods and materials of instruction.

2. Difficulties of young children in auditory perception or visual discrimination might be overcome by specific training.

3. Success in beginning reading achievement in first grade was highly correlated to children's previous opportunities for reading at home, in the community, or in the kindergarten.

4. Children could be taught to read at earlier ages than they were being taught in most public school systems. Many investigations have established this point. Additional research was needed in which the time of beginning the teaching of reading was systematically varied, using a method of teaching specially designed for the age level at which it was to be employed with special attention paid to the effects of the time of beginning on the later development of the child.

In formulating the Denver Research Project, the decision was made to examine particularly the question of when to begin and the long range effects.

Objectives

Six objectives (see page 35) therefore, were formulated dealing with comparisons to be made among four experimental treatment groups. The main variable distinquishing the groups was the time of beginning the teaching of reading, either kindergarten or first grade. A second variable, important for clarifying results, dealt with adjustments in the reading program in the first and following grades. This involved comparison of the regular program of reading instruction which had been in use in the Denver Public Schools with a program adjusted to any gains made through the experimental method used in beginning reading instruction.

The trial methodology consisted of a series of steps or informal activities designed to help boys and girls begin to learn to read. That methodology and its accompanying materials are described in Chapter III.

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Chapter III

THE INSTRUCTIONAL METHODS AND MATERIALS

The Experimental Instruction

Any word as it appears in reading matter has a printed form, a spoken form, and a meaning. The printed form is the little piece of print that the reader sees on the page. The spoken form is the pronunciation that anyone utters when he says the word correctly and that he hears when he listens to someone speak the word. The meaning is the sense that the word is intended to convey in the particular setting in which it is used. The printed form stands for both the spoken form and the meaning.

Each strange word included in reading matter suitable for the pupil's use in beginning to learn to read is strange to him only in its printed form. Through ample experience in listening and talking, he has already become thoroughly familiar with both the spoken form and the meaning and has associated those two with each other so well that as he hears, thinks, or speaks the spoken form he automatically thinks the meaning. The important thing he does not yet know and must find out in order to read the word is just which of the thousands of spoken forms already familiar to him is the one that the strange printed form represents.

An extremely important part of instruction in beginning reading is the teaching that equips the pupil with skill needed for calling to mind independently the familiar spoken form and consequently the meaning for which a given strange printed word stands. With control of this skill, the pupil is in a position to engage in reading on his own much suitable material intended for his use. Without such control, his independent reading is necessarily limited to the use of the available meager material composed entirely of the few words he already knows well in print.

Several years ago, Paul McKee and M. Lucile Harrison developed a program of instruction directed at equipping the pupil with the skill referred to in the preceding paragraph. Essentially this instruction culminates in teaching the pupil a definite and economical technique or procedure to follow in calling to mind the familiar spoken form for which a given strange printed word stands. That procedure consists of using first and together the context - the sense of what is being said - and the beginning sound of the strange word, and then only as many of the remaining sounds represented in the word as are required for making sure of the needed spoken form. Using the context and the beginning sound together limits the pupil's choice to familiar spoken words which make sense and begin with that sound. Using only some of the remaining sounds enables him to decide quickly just which familiar spoken word that makes sense and begins with the right sound is the correct one and makes unnecessary any laborious sounding out of the word.

Certain instruction preliminary to the complete teaching of the technique itself was described and illustrated in detail in a teacher's guide labeled *The Program in Skills Basic to Beginning Reading*.[1] This instruction consisted in (1) giving practice in using only context, spoken or read aloud by the teacher, to think of a word that could come next to make sense, (2) giving practice in listening for consonant sounds as used at the beginning of words, (3) giving practice in distinguishing letter forms from one another, both capital and lower case forms, and teaching the names of the letters, (4) giving practice in using together spoken context and the beginning consonant sound supplied by the teacher to think of a word which begins with that sound and could come next to make sense, (5) teaching the letter-sound associations for the consonants *b*, hard *c*, *d*, *f*, hard *g*, *h*, *l*, *m*, *n*, *p*, *r*, *s* as in *sit*, *t*, *w*, *ch* as in *chill*, *sh*, *th* as in *thumb*, *wh* as in *whip*, (6) giving practice in using together spoken context and a shown consonant letter to think of a word which begins with the sound of that letter and could come next to make sense, and (7) giving practice in using together spoken context and the beginning consonant sound to decide what a word shown by the teacher is.

Basic to the experimental system are three relationships between spoken language and the printed language; (1) any printed words represent the spoken form of that expression and stand for the same meaning, (2) children have had several years experience in getting correct meaning from spoken sounds of language before they began to read, and (3) once the correct associations between printed symbols and spoken sounds are established, the mental process of getting meaning from a printed page is facilitated. The experimental instruction is described briefly in the section which follows.

THE KINDERGARTEN PROGRAM

The experimental instruction given to kindergarten pupils consisted in carrying on the seven teaching activities listed previously. At the beginning and for some time thereafter, teachers were encouraged to (1) limit the instruction to not more than twenty minutes each day, (2) proceed at a rate in accordance with the interest and ability of their pupils, (3) refrain from pushing any activity faster than their pupils could proceed with reasonable success and pleasure, (4) carry on each activity somewhat as a game to be played, (5) drop back to a simpler activity if the one being used at the time seemed too difficult for pupils, (6) stop for a short time any activity in which pupils could not do today what they did previously, (7) excuse from any activity pupils who do not seem to be capable of taking part successfully, and (8) refrain from pushing pupils in any sense so that the instruction could be completed within any given time period or on any given date. These admonishments inferred that some pupils in the experimental group could learn all that the activities purport to teach, that some pupils could do some but not all this learning, that some could learn little if anything, and that each pupil without being pushed should be given the chance to learn all that he could.

The following paragraphs describe briefly the purpose and nature of each of the seven teaching activities.

Using Only Context

To make pupils aware of the fact that context can be used as a clue to a word and that with any given context any one of two or more words makes sense, they were given practice in supplying words that made sense with context spoken or read aloud by the teacher. Sometimes the spoken contexts consisted of all the words except the last in each of short unrelated sentences, and the pupils were asked to supply there, one at a time, different words that made sense. The following are examples:

Johnny drank his _______. (milk, juice, coke, water)
Sally went wading in the _______. (pool, lake, river, ocean)
Tom fell down and broke his _______. (leg, glasses, wrist, arm)

Some contexts were short episodes consisting of several sentences with the last word in the last sentence being omitted, and in each the pupils were asked to supply there, one at a time, different words that made sense. The following is an example:

> As Ann was riding her tricycle on the front walk, she heard something. It was very far away and the sound was hard to hear. She stopped and listened. It came closer and closer and the sound got louder and louder. She looked down the street. Around the corner came a ______. (fire engine, parade, band, police car)

Other contexts were extended incidents broken into several parts, each of which contained one or more sentences and in which the last word was omitted for pupils to supply there, one at a time, different words that made sense. Additional contexts were entire stories in which a word was omitted in various positions and the pupils were asked to supply for each omission any word that made sense.

All the practice needed to achieve the purpose of instruction in using only context was completed before the use of the remaining six activities was initiated. In carrying on those six activities, the eighteen consonants listed on page 19 were arranged in five groups and the use of each group in all six activities was completed before the use of another group was begun. With each group of consonants, the six activities were carried on in the order indicated by the descriptions that come next.

Listening for Beginning Consonant Sounds

The purpose of giving pupils practice in listening for beginning consonant sounds in words was to teach them what is meant by the beginning of spoken words, make them aware of the fact that consonant sounds are used at the beginning of words, and acquaint them with the meaning of such directional expressions as "begins with the same sound," "begins with a different sound," "begin alike," "start the same way," etc. The purpose was not to teach the pupil to "hear" the consonant sounds or to distinguish those sounds from one another. Pupils who speak English have already learned to do these things, else they could not possibly be speaking the language or understanding much of it in spoken form. What the pupils do not yet have and need to acquire if they are to learn to use the technique described on page 18 is an understanding of what is meant by the beginning of a spoken word and by directional expressions the teacher will use in teaching the technique.

Many different exercises were used in providing the instruction needed for achieving the purpose just stated. In general these exercises were concerned with (1) explaining what is meant by the beginning of a spoken word, (2) having pupils note that or decide whether given spoken words begin with the same sound, and (3) having pupils decide whether a given spoken word begins with a given sound. In all exercises, either or both the teacher and the pupils spoke all the words and no printed letters or words were shown.

Typical exercises used were those in which the pupils (1) collected small objects that have names which begin with the same sound, (2) sorted and placed in a box small objects that have names which begin with the same sound, (3) chose from among mixed objects those which have names that begin with the same sound, (4) placed in a box objects that have names that begin with the same sound as the name of an object already in the box, (5) placed on a page of a scrapbook pictures of objects that have names which begin with the same sound as the name of a picture already on the page, (6) placed in a pocket chart picture cards that have names beginning with the same sound as a picture already there, (7) selected from mixed picture cards those that have names beginning with the same sound, (8) took from a row of picture cards the one that has a name which does not begin with the same sound as the names of the other cards, (9) matched from picture cards that have names beginning with different sounds those which begin with the same sound, (10) matched picture cards and objects that have names beginning with the same sound, (11) decided which word among several spoken by the teacher does not begin with the same sound as the others, and (12) supplied words that begin with the same sound as several words spoken by the teacher.

Distinguishing Letter Forms from One Another

When pupils begin to read, they will need to recognize and use individual letters and groups of letters at the beginning of words. Furthermore, the names of the letters are simple and convenient terms for pupils to use in thinking and talking about printed words and differences between those which look much alike. These are the reasons why the kindergarten program included giving pupils practice in distinguishing the letter forms from one another, both capital and lower case forms, and in connection with this, teaching the names of the letters, without giving any attention to alphabetical order. There is no inference here that knowing the names of the letters is essential to learning to read, although some research has shown that pupils who achieve the greatest success in beginning reading know the letters by name.

Typical of exercises used to give pupils practice in distinguishing letter forms from one another and to teach them the names of the letters were (1) distributing among pupils a few different capital letter cards, placing a duplicate of one card in each row of a pocket chart and naming that letter, and asking pupils who have the same letter on their cards, to place those cards in the right row and name the letter, (2) distributing capital letter cards, naming a letter without showing it, and asking pupils who have cards with that letter to place them in a given row in a pocket chart, (3) placing capital letter cards in a row and asking pupils to name those letters, (4) placing capital letter cards in a row, asking pupils to name those letters; showing, naming, and placing beside each capital the corresponding small letter card, and then asking pupils to name the small letters, (5) placing mixed capital letter and small letter cards in a row and asking pupils to name each letter, and (6) having the pupils play a game called Letto in which each pupil has a different card showing the letters printed in rows and he covers each letter as the teacher names it.

Using Context and the Beginning Consonant Sound

The purpose of this activity was to give pupils practice in using together context spoken or read aloud by the teacher and a beginning consonant sound supplied by her to think of a word that begins with the right sound and could come next to make sense.

In all exercises used to achieve this purpose, the oral context consisted of single unrelated sentences with the last word in each omitted, short episodes composed of several sentences with the last word omitted, and complete stories in which different words were omitted here and there. For each omission, the teacher asked the pupils to supply a word which made sense and began with the same sound as two other words she named. Any supplied word which met these two criteria was accepted. The following is typical of exercises used:

> Tom decided to build a pen for his pet rabbit. He knew just how to make it and had all the tools he needed except one. The name of that tool begins with the same sound as sit and sat. He needed a _____.(saw) If the name of the tool had begun with the same sound as hill and hot, it would have been a ______. (hammer)

Associating Letter Sounds and Forms

To make independent and simultaneous use of context and the beginning sound of a strange printed word as the first step in deciding what the word is, the pupil must have associated the form of the beginning letter or group of letters so well with the sound it stands for that when he sees the form he can think the sound immediately. That is why the kindergarten program included the teaching of the letter-sound associations for the eighteen consonant elements listed on page 19 . Often such associations are called phonics.

The materials used in teaching each of the eighteen associations were (1) picture cards and small objects that have names beginning with the right sound, (2) a letter card on which the right letter was printed, and (3) a key card. On this key card was printed a red picture of an object that has a name beginning with the right sound and superimposed there in black as a part of the picture was the form of the right letter. The object suggests the sound of the letter and the form of the letter suggests the beginning sound of the name of the object.

Typical of exercises used in teaching each association were (1) showing picture cards that have names beginning with the same consonant sound; having pupils name the cards and noting that they begin with the same sound; showing the right letter card and having pupils name it; and telling them that the letter stands for the sound they hear at the beginning of the names of the cards, (2) showing the key picture card, having pupils name the picture and the superimposed letter, and explaining that remembering the letter used in the picture will help them remember that the letter stands for the sound at the beginning of the name of the picture, (3) showing the letter card and asking pupils to name the key picture in which it is used, (4) fastening the letter card to a box and having the pupils select from among mixed small objects and place in the box those that have names beginning with the sound the letter stands for, (5) placing a different letter card at the left end of each of two or three rows in a pocket chart and having pupils place in each row picture cards that have names beginning with the sound the letter stands for, and (6) placing a different letter card at the left end of each of different rows in a pocket chart, putting in each row two correct and one incorrect picture cards, and having pupils rearrange cards so that all the right cards are in the right row.

Using Context and the Beginning Letter

The technique which pupils are to follow in calling to mind the familiar spoken form for which a given strange printed word stands was explained on page 19 . In putting that technique to work, the pupil is to use first and together the context and the beginning sound of the strange word. It was the purpose of the instruction described in this section to give him practice in doing that by using together context spoken or read aloud by the teacher and the sound that a shown beginning consonant letter or group of letters stands for.

The contexts spoken or read aloud by the teacher were single unrelated sentences in which the last word was omitted, short episodes which consisted of several sentences and in which different words were omitted here and there, and complete short stories in which words were omitted in various positions. For each omitted word, the teacher showed a card on which was printed the consonant letter or group of letters with which that word begins and the pupils were asked to supply there any word which made sense and began with the sound the shown letter stands for. Any supplied word which met these two criteria was accepted. The following paragraph, addressed to the teacher, is illustrative of exercises used:

> Have at hand the letter cards for c, m, r, and d, arranged in that order. Say: Bob went to the pet store to choose a pet for his birthday. He looked at all the animals. One rubbed against his leg. It was a (hold up c and point to a pupil) ______. . .(cat) Another climbed up a rope. It was a (hold up m and point) _____. . .(monkey) Then Bob saw an animal that had hardly any tail. It was a (r - point) _____ . . .(rabbit) Finally he saw the one he thought he would have the most fun with. It was a (d - point)_____. . .(dog) [2]

Using Context and the Strange Printed Word

The instruction given by this seventh and last teaching activity was quite similar to that supplied by the immediately preceding activity. Contexts spoken or read aloud by the teacher were much the same in nature. However, for each omitted word the teacher showed a card on which that entire word rather than just the beginning consonant letter or group of letters was printed. Great care was taken to see that the printed word was the only word within the pupils' listening vocabulary which made sense and began with the right sound. For each omission the pupils were asked to tell what the shown printed word was.

It should be clear that carrying on the seven teaching activities which made up the kindergarten program was not intended to provide all the instruction the pupil needs in order to learn the technique to be followed in calling to mind the familiar spoken form for which a given strange printed word stands. Those activities equip him to use together the context and only the beginning consonant sound of the strange word. Instruction that comes later will teach him to use also some of the additional sounds represented by letters and groups of letters in the word.

THE ADJUSTED PROGRAM

Not long after the experimental kindergarten program was put into operation, several important propositions became evident. These were (1) that several weeks if not months before the end of the school year, most pupils in the experimental group would complete their learning of what the seven teaching activities offer and, if not provided with further appropriate instruction, during those weeks, would fail to make the immediate progress they could make, (2) that in the first grade, the regular program used in the Denver schools, described on page 30 provided for the teaching of items which these pupils would have already mastered and did not call for the teaching of additional items which they would be quite capable of learning then, and (3) that if the experimental pupils were to be allowed and encouraged to capitalize on what they had learned in the kindergarten and to make the progress they could make in the first grade and each subsequent grade, certain adjustments should be made in the regular program. When made, the adjustments consisted largely in adding certain items to the kindergarten program, adding items to and deleting others from the regular program at some grade levels, and adding items to the regular program at other grade levels. It is the purpose of the remainder of this chapter to briefly describe these adjustments.

Adjustments in the Kindergarten

After the seven teaching activities had been completed, the following pieces of additional instruction were undertaken:

1. Teaching the letter-sound associations for the consonants j, k, v, y as in yet, and th as in think.

2. Giving pupils practice in using together context spoken or read aloud by the teacher and the beginning sound of a strange printed word that begins with one or another of the five consonant elements mentioned above to decide what the strange word is.

3. Teaching the fourteen printed service words - to, the, that, a, an, and, are, at, I, in, is, it, of, on - which with their repetitions comprise one-fourth of all printed English. Each of these words was introduced to the pupils in context spoken or read aloud by the teacher, and the pupils were asked to use that context, the beginning sound, and other consonant sounds represented to decide what the word was. When a word introduced was one that began with a vowel, pupils were acquainted with the letter-sound association they needed to know and use there. Provision was made later for giving pupils the practice they needed for learning to recognize the fourteen words instantly in print. It was anticipated that if the pupils knew these words well in printed form before they began to read preprimers, their reading of those books would be much expedited.

4. Having pupils read the first and subsequent preprimers that were parts of the basal readers used in the first grade of the school which the pupils attended. Each new word in a preprimer was introduced in context spoken or read aloud by the teacher and the pupils were asked to use that context, the beginning sound, and other consonant sounds represented to decide what the word was. Through these introductions, the pupils were given the practice they needed for improving their control of the technique to be followed in calling to mind the familiar spoken form for which a given strange printed word stands.

Adjustments in the First Grade

The following adjustments were made in teaching each class, regardless of the particular basal readers being used:

1. The teaching of letter-sound associations which early testing showed the pupils already knew was omitted.

2. The reading of whatever preprimers pupils had read in the kindergarten was omitted.

3. Letter-sound associations for common endings such as ing, ed, ly, and est added to base words in making variants were taught.

4. Letter-sound associations for vowels as used at the beginning of words were introduced.

5. Pupils began their reading with the use of a preprimer or the primer of the basal readers being used in the school they attended, whichever book came next immediately following what they had read in the kindergarten. As the year progressed, pupils read in order the first grade reader, second grade readers, and in some cases third grade readers.

6. Each new word in a preprimer and the primer and each of some of those in the first reader was introduced to pupils in printed context or context spoken or read aloud by the teacher. Pupils were directed to use that context and the beginning sound and then only as many of the remaining consonant sounds as were needed to call to mind the familiar spoken form which the printed word represented. In this way pupils were given practice needed for learning to use letter-sound associations for consonants in whatever positions they occur and thus to sharpen their control of the technique to be followed in attacking words strange to them only in print.

7. During the year, suitable juveniles were provided for individual pupils to read on their own. Many of these books contained here and there words which were strange to the pupils only in print but which they were equipped to attack independently with success.

Adjustments in the Second and Third Grades

Regardless of the basal readers being used in the school which the pupils attended, adjustments made in the second and third grades were:

1. Letter-sound associations which early testing showed the pupils did not yet know for vowels were taught in the first part of the second grade. At most, this teaching included only associations for the short sound and the long sound of each single vowel and associations for the most common vowel combinations such as ea, ai, oo, and ow.

2. Second grade pupils were taught letter-sound associations for common syllables such as tion, ment, de, ex, and gle

and were given practice in using those associations with the context to call to mind the familiar spoken form represented by a word strange to them only in print.

3. At each grade level, pupils began their reading with the use of the basal reader that came next immediately following the last reader they had read in the preceding grade. During the year, this reading progressed to the use of readers commonly used at higher grade levels.

4. At each grade level, very few of the new words that appeared in a given selection in the basal reader being used and that were strange to pupils only in print were introduced to them before they read the selection. For the most part, pupils were expected to apply to each such word the technique they had been taught to follow in attacking that word independently.

5. At each grade level many suitable juveniles were provided for pupils to read in and out of school. In addition, teachers were supplied with suggestions relative to principles to be followed and instructional activities to be carried on in helping pupils to develop an interest in and taste for reading on their own a variety of children's literature on a wide range of topics.

6. In the teaching of social studies, science, and other context subjects in the third grade, pupils were supplied with suitable detailed books for them to read in order to enrich their understanding of topics presented and discussed briefly in the textbook being used. In addition, teachers were provided with suggestions for making their instruction in social studies and other content subjects contribute to rather than hamper the development of pupils' reading ability.

7. Because some of both the informative and the recreatory reading matter used by third grade pupils contained words and other items strange to them in meaning, certain skills needed for coping independently with those difficulties were introduced. These skills were (1) using the context to get the meaning of a word that is strange in meaning, (2) using a dictionary to get the needed meaning of a word, (3) interpreting the simple type of unfamiliar metaphor, and (4) interpreting certain uses of punctuation marks essential to understanding what reading matter says.

Adjustments in the Fourth and Fifth Grades

All adjustments made at each of these grade levels were additions and consisted of the following:

1. At the beginning of the school year, all pupils were tested on their knowledge of the particular letter-sound associations taught in the kindergarten, Grade 1, and Grade 2 and on their skill in using the technique to be followed in calling to mind the familiar spoken form represented by a word strange only in print. Then all pupils whose achievement in these matters was judged to be deficient were taught the letter-sound associations they did not know and were given practice in using the technique. Suggestions for doing the testing and providing the needed instruction were supplied by a locally produced bulletin entitled Phonics Maintenance.[3]

2. Through bulletins prepared locally, teachers were provided with detailed suggestions for teaching certain skills helpful to pupils in coping independently with meaning difficulties encountered in their reading matter.[4] These skills were (1) using context to figure out the meaning of a word strange in meaning only or in form, meaning, and pronunciation, (2) using a dictionary to get the meaning of a word, (3) using a dictionary to get the pronunciation of a word, (4) interpreting simple unfamiliar metaphors, (5) interpreting crucial uses of punctuation marks, (6) sensing the relation that sentences in an informative paragraph have with one another, and (7) thinking correct stress.

3. At the beginning, pupils used the basal reader which followed immediately the reader they read last in the preceding grade. During the year, this reading progressed to the use of readers intended for higher grade levels. No new words that appeared in a given selection and that were strange only in print were introduced to pupils before they read that selection; to each such word, pupils were expected to apply the technique they had been taught to follow in attacking that word. Any word strange only in meaning or in meaning, form, and pronunciation was introduced only if up to that time pupils had not been taught how to use a dictionary to get either or both the meaning and the pronunciation of that word. After those skills had been taught, pupils were expected to apply them in attacking words strange only in meaning or in meaning, form, and pronunciation.

4. Other bulletins prepared locally gave teachers detailed suggestions for teaching certain skills useful to the pupil in his study of informative material.[5] These skills were (1) using the index of a book, (2) locating quickly on a page the particular information to which the index refers, (3) deciding what the topic of an informative paragraph is, (4) adjusting rate and manner of reading to one or another of the purposes for which the reading may be done, (5) outlining ideas presented in an informative selection, and (6) interpreting graphs.

5. Teachers were provided with suggestions for teaching social studies and other content subjects in a way which encouraged pupils to demand meaning in their reading and to use in their study the various skills they had been taught. Assignments to reading on a given topic, problem, or question directed pupils to gather information independently on that topic from different informative books as well as the textbook. Procedures in the study period encouraged pupils to try to resolve reading difficulties they encountered by using skills they had been taught and to organize the information they gathered from different sources. Class discussions discouraged pupils' use of verbalism, emphasized the clarification of ideas they had gained through reading, encouraged them to present in an organized form the information they neededto contribute on the problem under discussion and encouraged them to engage in further reading on that topic.

6. Considerable emphasis was placed on helping pupils continue their development of an interest in the reading of juvenile literature. Numerous trade books and suitable children's magazines were made available to them. Teachers were provided with detailed suggestions pertaining to individualized reading and different types of activities with which to foster an interest in reading literary selections. These activities included among others (a) a free-choice silent reading by pupils, (b) oral reading by individual pupils of brief selections they had enjoyed and wished to share with their classmates, (c) oral reading by the teacher, and (d) oral introducing of books to the class by individual pupils or the teacher.

THE REGULAR READING PROGRAM

The regular reading program taught certain groups was that followed in the Denver Public Schools up to the time this study was initiated. It was a sound program based upon the use of the several major basal reading series which had been adopted by the school board. The teacher guides which accompanied the basal readers provided direction for the instructional procedures. General guidelines for the program also were set forth in the Denver Public Schools Reading Guide.[6] In some ways this regular program contrasted sharply with the experimental program.

THE KINDERGARTEN INSTRUCTION

A major difference between the experimental and regular program was in the nature of the kindergarten program. In the regular program, no organized, sequential reading instruction was provided in the kindergarten. A conventional program in reading readiness was followed in the kindergarten. Reading readiness activities at this level were of an incidental variety. These pre-reading experiences were designed to improve children's memory and to develop the ability to do abstract thinking. The activities were intended to teach children to discriminate between colors, objects of similar and different size and shapes. The kindergarten readiness program also provided for the development of directional sense as a prelude to the left to right eye movements required for reading. A major part of this program consisted of the informal experiences designed to encourage the development of language skills which would serve as a base for reading later in the first grade. The kindergarten also sought to teach children to listen carefully and to sharpen their auditory sensitivity. Through first hand experience, use of pictures and the like interpretative ability was to be nurtured. Motivation for later reading was to be strengthened through listening to stories, poems, and riddles.

The reading aspects of the regular kindergarten program were best characterized as informal and incidental. The specific activities, typical of those in most kindergartens, were detailed in the Kindergarten Guidebook.[7] Thus, in the regular program no systematic instruction in reading itself was provided in the kindergarten, although, a conventional program in reading readiness was followed there.

THE LATER GRADES

The second important difference between the experimental and regular reading programs was in the rate of instruction. Generally, the instructional program of the experimental group was at an accelerated pace. The teaching of letter-sound associations, including those for consonants, vowels, endings and other syllables was initiated for the regular group in the latter part of the first grade and continued through the third grade. The basic reading instruction of the regular groups was supplemented by additional phonic teaching.

In the intermediate grades activities were provided to develop reading speed and comprehension. The pupils were taught to use indices, glossaries, encyclopedias, dictionaries, and other reference materials. Materials were provided for the development of specialized reading skills and techniques of word analysis. In grades three through five, typical reading lessons included (1) introducing selections in the basal readers, (2) teaching the strange words or phrases in those passages, (3) having pupils read the selections silently, (4) carrying on discussions of the content read, (5) having pupils read aloud parts of a given selection, and (6) having them complete exercises in the workbooks which accompanied the basal readers.

The daily reading instruction of the regular group was based upon the appropriate grade level basal reader. The accelerated reading program of the regular groups centered about the use of individual titles--library books--and supplemental reference materials. In addition to the usual reference materials, the encyclopedias and dictionaries; supplemental social studies texts, science books, and other materials were available at advanced levels.

Summary

In summary, it can be seen that the experimental program consisted of the early, sequential development of certain skills basic to reading in the kindergarten. The kindergarten reading instruction was followed by an accelerated program in grades one through five. This program was designed to take the pupils as far and as fast as possible.

The regular reading program was characterized by typical kindergarten readiness activities. In grades one through five, the acceleration was by means of trade books and supplemental materials. The basal readers designated to be used at certain grade levels by their publishers constituted the basic instruction. The reading program of the regular reading groups was quite similar to that in use in many schools using the basal reader approach.

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Chapter IV

PROCEDURE

On the basis of knowledge provided from the review of previous research on reading, it was decided that the investigation must meet certain requirements.

Appropriate Instructional Method and Material

A basic requirement was an experimental method and accompanying materials appropriate to the developmental level of the group being taught. Because of the importance of method and materials which could be used in beginning the teaching of reading to the kindergarten, those prepared by McKee and Harrison and used in the study received extensive trial in the Denver Public Schools and in schools of other communities. The materials first produced in 1958 received a three month trial in 12 Denver kindergartens during the 1958-1959 school year. Teacher comments and observations made by the authors led to revisions in the method and the materials. The rewritten materials were again tried in more kindergartens on an extended basis for an entire school year. Evidence from this preliminary use of the methods and the materials indicated that they met the criterion of appropriateness for kindergarten pupils.

Extended Evaluation

It is recognized that initial results could be inconclusive or even misleading. Because of this, it was decided that testing of reading achievement and interest should continue over an extended period of time so that the permanence of any advantage gained in the kindergarten could be assessed. A concomitant necessity seemed to be the adjustment of the program of instruction in reading following the beginning level to permit the experimental groups to progress at a pace in accordance with any advantages those pupils had gained from the instruction in the kindergarten. It also was decided that special attention should be directed to the presence of reading disabilities among pupils who received the experimental instruction in the kindergarten. Similarly, it seemed necessary to test progress in other school subjects that had been affected by the experimental instruction.

Research Requirements

An appropriate method of statistical analysis which permitted consideration of the influence of numerous variables was deemed necessary. Analyses of variance seemed to be a technique suited to the demands of the study. An adequate population sample was a requisite if comparison between the research groups could be made with confidence.

Because of the complexity of the research project, it was thought advisable to secure competent research consultants. Dr. Wilbur Schramm, Director of the Stanford Institute for Communication Research suggested the original research paradigm. Dr. John Hayman, then a research associate of the Stanford Institute, assisted in establishing the statistical methodology to be followed. Dr. Howard Gruber, then of the University of Colorado Behavioral Research Laboratory, also served as research consultant, as did Dr. Theodore Albers, then Director of Research for the Colorado State Department of Education.

Dr. Kenneth E. Oberholtzer, Superintendent of the Denver Public Schools, and Dr. Roy A. Hinderman, Deputy Superintendent, initiated the project and actively participated in constructing the research design. Dr. Joseph E. Brzeinski was appointed Project Director for the investigation. Mr. Lloid B. Jones, Executive Director for Elementary Instruction, made possible the implementation of the research design.

GENERAL METHOD AND DESIGN

It was proposed that the experimental instruction in beginning reading be given to two experimental groups in the kindergarten and to a control group in the first grade. Another control group would have the usual kindergarten program and the regular reading program in the first and later grades.[1] All groups were to receive similar amounts of instruction. The time of beginning reading instruction was the main variable. Hypotheses were constructed which would help in determining the effectiveness of beginning the teaching of reading in the kindergarten.

The Hypotheses

Following are the hypotheses of the research as finally formulated and a brief description of how each hypothesis was tested.

Hypothesis I - The experimental groups will show significantly greater achievement in reading at the end of the first grade than will the control groups.

> A specially constructed test with comparable alternate forms was used as a pretest and post-test to measure the degree to which pupils possessed basic reading skills

prior to and following kindergarten instruction. The Gates Primary Reading Test and the Gates Advanced Primary Reading Test were administered to the experimental and control groups at the end of the first grade. These tests provided a score for word recognition (vocabulary), for sentence reading, and for paragraph reading (comprehension). These are generally considered to be important aspects of reading achievement at the first grade level. Appropriate statistical treatment was given to these scores to determine if a statistically significant difference existed between the achievement of the control and the achievement of the experimental groups.

Hypothesis 2 - The experimental groups will have significantly greater reading rate, reading vocabulary, and reading comprehension at Grade 3 and Grade 5 than will the control groups.

> The Gates Reading Survey was given at the end of Grade 3 and Grade 5, and the Stanford Achievement Test was administered at the end of Grade 3 and Grade 5. These tests provided scores for reading speed, accuracy, vocabulary, level of reading, and total reading ability, and the like. These scores were given appropriate treatment to determine if statistically significant differences existed.

Hypothesis 3 - The experimental groups and control groups will show no significant differences in the number of pupils who evidence reading and other related disabilities at Grade 3 and Grade 5.

> The difficulties involved in testing this hypothesis were recognized. The methods involved testing for visual defects and hearing acuity by school nurses. School adjustment and attitude toward learning was checked through use of pupil records compiled by school social workers and psychologists. The existence of specific reading disabilities was determined through use of an experimental version of a Stanford Diagnostic Test.

Hypothesis 4 - The experimental groups will make significantly greater gains than will the control groups in achievement in certain other academic subjects in Grade 3 and Grade 5.

> In studies of this type, the longitudinal effects need to be considered. What will be the difference between the experimental and control groups several years later? To secure answers to this question, the appropriate battery of the Stanford Achievement Test was administered to the pupils of the control and experimental groups in Grades 3 and 5. These tests provided scores in arithmetic, reading, science, study skills, and social studies. The scores were analyzed to determine patterns of differences which existed between the control and experimental groups.

Hypothesis 5 - The experimental groups will evidence greater interest and enjoyment in reading in Grade 1, Grade 3, and Grade 5, as indicated by the quantity of reading and other appropriate measures, than will the control groups.

> Records were kept by teachers on the amount of independent reading done by pupils in the school and at home.

Hypothesis 6 - The experimental group, receiving a program of instruction in the first and following grades adjusted to gains made in kindergarten, will be superior to the other groups on the criterion variables mentioned in the preceding paragraphs.

> The test of this hypothesis depended upon additional testing and comprehensive treatment of the results of the study.

Establishment of Experimental and Control Groups

When the study began in 1960, the Denver Public Schools had about 9,000 children enrolled in 300 kindergarten classes. This study involved 122 classes randomly assigned by school to control and experimental groups. Approximately 4,000 pupils were assigned to comparable control and experimental groups for instruction. Because it was thought that the attrition rate might be higher in the experimental groups, more pupils were assigned to the kindergarten reading groups than to the control classes. Thus, the control classes (Group I and II) had 750 pupils each, and the experimental classes (Group III and IV) had 1,250 pupils each.

Experimental Design

The basic research plan required an experimental group, a modified experimental group, a control group, and a modified control group. The experimental groups were given instruction in the experimental beginning reading activities for nearly twenty minutes per day. The children in the control group followed the regular kindergarten program as detailed in the Kindergarten Guidebook. [2]

Pupil experiences in the kindergartens and the aptitudes developed have a direct bearing upon what constitutes the most suitable instructional program in the first grade. Gains made by the experimental group in the kindergarten may be masked later by unsuitable instruction in the first and following grades. Therefore, although the primary intent of the research was to investigate the effects of beginning instruction in the kindergarten, it was necessary to adjust the program in the first and succeeding grades for some of the experimental groups. Both the control and experimental groups were subsequently subdivided into two programs. This division produced four first grade groupings.

This plan can be seen in the following chart:

BASIC STRUCTURE OF RESEARCH PROJECT

Grade	CONTROL	and	EXPERIMENTAL GROUPS	
Kindergarten	Regular kindergarten, readiness activities--no systematic reading instruction		Regular kindergarten plus experimental beginning reading program	
First through fifth grade	I	II	III	IV
	Regular reading program	Experimental beginning reading program followed by adjusted experimental reading program	Regular reading program	Adjusted experimental reading program
N =	750	750	1250	1250

Description of Groups

Group I. In the study, Group I had the regular kindergarten program of the Denver Public Schools.[3] This was a strong conventional kindergarten program comparable to the program followed in many urban school systems throughout the United States. In grades one through five, Group I pupils were taught the regular reading program that the Denver Public Schools had followed for a number of years. This program was representative of good reading instruction as set forth in the materials available in standard texts provided by a number of major publishing companies. This group was used as the straight control group throughout the study.

Group II. Group II had the regular Denver Public Schools kindergarten program and was a control group for the first year of the study. They began the experimental beginning reading program in the first grade and followed with an adjusted reading program thereafter. The purpose of establishing Group II was to test the effectiveness of introducing the experimental beginning reading program a year later, at the time when reading instruction was usually begun. This group was referred to as the delayed-experimental group.

Group III. The designation of Group III was given to those schools where children had the experimental beginning reading activities in kindergarten. Thereafter, in the first through fifth grades, this group used the regular Denver Public Schools reading program. The purpose set for Group III was to measure gains, if any, made by the early start in kindergarten using the experimental beginning reading activities when no follow-through was attempted. Group III constituted the short-term experimental group.

Group IV. Group IV was the true experimental beginning reading activities group. The children in Group IV had the experimental beginning reading activities in kindergarten and the adjusted experimental reading program from first through fifth grades using the techniques and materials developed for the study. This group was designated as the experimental group.

Group I provided a useful base against which to compare other groups. Group II permitted comparisons between groups who received the same instruction introduced at different times. Group III made possible assessment of the effect of introducing reading in the kindergarten when a regular reading program was followed in the first and later grades. Group IV had the experimental reading program in kindergarten and a reading curriculum in the first grade adjusted to be consistent with the kindergarten instruction and accelerated to take advantage of gains made in kindergarten.

Teachers of all four groups were supplied with appropriate direction and materials. In an attempt to control the Hawthorne effect, teachers of both control and experimental groups were provided comparable supervisory consultation and inservice meetings. It was expected that the Hawthorne effect would tend to be most strongly felt in the beginning: the number of years devoted to the present study would tend to minimize this effect.

It should be noted that approximately 1/8 of the elementary schools in Denver are in the inner-city augmented reading instruction with another experimental structured phonics program. These schools were not included in the study. However, 20 inner-city schools participated in the study.

The regular reading program was that described in the Denver Public Schools Reading Guide.[4] It was similar to those programs suggested in teacher's manuals of most basal readers. The adjusted reading program had two characteristics (1) it was modified to continue use of the experimental technique with adopted basal readers, and (2) it provided for their use at an accelerated pace. In both programs, emphasis was placed upon pupils' extended reading involving the use of individual library books.

In order to control instructional variations, a team of itinerant teacher-coordinators was established. The purpose of of this procedure was to insure, in so far as possible, that pupils in the various study groups had the specific type of instruction designated. Through frequent visitations, conferences, and demonstrations, the influence of instructional differences of individual teachers was minimized during the course of the study.

Long Range Study

To determine the long-range effects of the study, pupils tested at the end of the first grade were tested again in each later grade for a period of five years. This would indicate the permanence of any gains made by the groups at the end of the initial phases of the experiment. Details of this testing follow:

Testing Schedule

Kindergarten	Oct.	1960-61	Test of Skills Basic to Beginning Reading, Form A
Kindergarten	Jan.	1960-61	Test of Skills Basic to Beginning Reading, Form B
Kindergarten	May	1960-61	Test of Skills Basic to Beginning Reading, Form A
First Grade	Oct.	1961-62	Kuhlmann-Anderson IQ Test, Form A
First Grade	May	1961-62	Gates Primary Reading Test
First Grade	May	1961-62	Gates Advanced Primary Reading Test
Second Grade	May	1962-63	Stanford Achievement Test, Elementary Battery, Form N
Third Grade	Oct.	1963-64	Kuhlmann-Anderson IQ Test, Form CD
Third Grade	Nov.	1963-64	Stanford Diagnostic Reading Test, Form M
Third Grade	April	1963-64	Gates Reading Survey, Form 3
Third Grade	May	1963-64	Stanford Achievement Test, Primary II Battery, Form W
Fourth Grade	May	1964-65	Stanford Achievement Test, Intermediate I Battery, Form W
Fifth Grade	Oct.	1965-66	Kuhlmann-Anderson IQ Test, Form EF
Fifth Grade	Oct.	1965-66	Stanford Diagnostic Reading Test, Form X
Fifth Grade	Nov.	1965-66	Gates Reading Survey, Form I
Fifth Grade	Jan.	1965-66	Stanford Achievement Test, Intermediate II Battery, Form X

In addition to the tests administered to pupils, other pertinent information which might influence achievement was collected. This included the occupation and education of parents, number of siblings, and so on. This information was used in controlling background variables in the statistical evaluation of experimental groups.

Method of Statistical Analysis

Throughout the study, the principal statistical technique was analysis of variance; covariance method. The primary variable considered was the time of beginning reading; other variables were mental age, chronological age, IQ, and family socio-economic status. These latter variables were also used as covariates.

Comparisons were made on the criterion variable (reading achievement) between experimental groups and combinations of groups. Effects of other variables were studied in the same way. Analysis of variance also allowed computation of the interaction between variables. A separate analysis was made with mental age, chronological age, IQ, and family characteristics using each as the independent variable. In every case, attention was given to the interaction of the treatment variable (time of beginning reading) with the other variables in determining the criterion variable (reading achievement, and the like). Because the design had large numbers of experimental subjects, the statistical work was programed for computer analysis. Results of this analysis are contained in the chapters which follow.

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Chapter V

READING ACHIEVEMENT DURING THE FIRST TWO YEARS

The findings obtained at the end of the kindergarten and those secured at the end of the first grade need to be considered in relation to each other. Although, many people might attach significance to reports that kindergarten youngsters had been taught to read, this was not a paramount consideration of the study. For as Smith has reported, "We have abundant evidence (the studies of Almy,[1] Cohan,[2] Durkin,[3] Keister,[4] Moore[5]) that children can be taught to read at an early age."[6] Rather, the purpose of the research project was to study the longe-range effectiveness of beginning the teaching of reading in the kindergarten. The kindergarten results, however favorable, were of only momentary interest. Any really significant findings were dependent upon the effects of the early reading instruction at later times in Grade 1, Grade 3, and Grade 5.

KINDERGARTEN RESULTS

The data gathered during the kindergarten year were acquired by the use of (1) a pre-test administered to pupils in October, 1960, (2) an alternate form mid-year test given in January 1961, and (3) a post-test given in May 1961. A teacher questionnaire provided additional information concerning teacher attitude. A parental questionnaire secured background information relative to socio-economic status, education of parents, number of siblings, and amount of reading help given in the home.

The adjusted total test score means reported in the tables which follow in the succeeding sections have been computed to two decimal places, the number rounded and the decimal point omitted in the tables. This reporting procedure follows that suggested by Diederich of the Educational Testing Service.[7]

Kindergarten Tests

The tests used in the kindergarten were alternate forms of the Test of Skills Basic to Beginning Reading.[8] The tests were selected because they evaluated achievement in the skills which other research has indicated are closely related to initial reading success, and because they measured what the experimental instruction in the kindergarten had attempted to teach.

Comparative Kindergarten Achievement

Basic to the entire investigation was the question:

- Could children learn the experimental beginning reading steps in the kindergarten?

The findings can be seen in Table I

TABLE I

COMPARATIVE KINDERGARTEN ACHIEVEMENT
Adjusted Test Score Means

	Control Groups - Incidental Readiness		Experimental Groups - Beginning Reading Steps		Level of Significance
Month Tested	Group I	Group II	Group III	Group IV	
Oct.	223	213	211	212	NS
Jan.	269	284	308	312	$< .001$
May	320	359	408	450	$< .001$

The Findings

The results presented in Table I showed that:

1. Kindergarten children could and did learn certain beginning reading skills.
   - They were able to learn letter forms, letter names, and letter-sound associations. The kindergarten children made substantial gains in initial alphabet and phonic activities and in the ability to use context with initial letter-sounds and forms. The gains of the experimental group were markedly superior to the gains of the control group.
2. A planned program of systematic instruction in beginning reading skills appeared to be more effective than a program which incidentally provided opportunity for the development of reading readiness.

- Both groups made gains. However, the planned program of systematic teaching of beginning reading skills, as provided by the experimental instruction, was found to be much more effective than a kindergarten program which only, incidentally, provided opportunity for the development of reading readiness. Examination of adjusted mean test scores showed that the kindergarten classes with the planned program of beginning reading experiences gained an average of 217 adjusted points while the classes with the incidental program gained an average of 121 adjusted points. This difference was statistically significant at the .001 level of confidence.

3. Children taught the beginning reading skills in kindergarten did not forget them during the summer school intermission.

   - The possibility existed that since the experimental classes seemed to learn more than the control classes, they might also forget more during the summer months when they were less actively engaged in learning activities. To check this possibility, 49 children in the experimental class and 49 children in the control group were given the same test in September 1961 when these children had just entered the first grade.

     The children taught the beginning reading skills in kindergarten did not forget them during the summer. The children in the experimental group had an average loss of 15 points while the children in the control group had an average loss of 35 points. This difference between these means was not statistically significant, indicating that children in the experimental group maintained their advantage during the summer months.

4. The pre-test scores confirmed the initial equivalency of the various research groups.

   - Although the classes in the study were randomly assigned to the various research groups, it was thought that the comparability of the research groups in terms of beginning reading skills should be verified. For this purpose, the initial administration of the _Test of Skills Basic to Beginning Reading_ was used as a pre-test. The equivalency of the groups was confirmed when the October test scores in Table I were examined. The average of the control group test score means was 213 and that of the experimental group was 212, a difference which was not statistically significant.

5. The learning of the beginning reading skills was distributed over the entire kindergarten year.

   - The kindergarten results were analyzed to determine if all or a major part of the learning occurred during the first or second semester. This was accomplished by using the January scores as the dependent variable and the October scores as the control variable to isolate by means of analysis of covariance the first semester learning. Second semester learning was isolated by designating the May test as the dependent variable and the January test as the control variable in a similar analysis.

     Each of these analyses disclosed that the experimental groups learned significantly more than the control groups during the first semester and during the second semester. This indicated two things. Learning began and proceeded in the first semester - it did not wait for greater maturity. Learning continued during the second semester - it did not reach an early plateau and remain stationary. This suggested that children can profit from planned reading experiences during the entire kindergarten year.

Not all children progressed at the same rate. Nearly all children made some progress in learning the seven steps of the trial program. Some children were able to read preprimers and primers during the last six weeks of kindergarten. Most were able to recognize letters, learn their names and sounds, and, with the help of context, read words.

Analysis of the teacher questionnaires and interview data showed that the experimental instruction could be carried on in the kindergarten without greatly modifying existing kindergarten programs through better utilization of the time presently available.

While the kindergarten results were important, it is recognized that the measurement of reading at the end of the first grade would provide more significant information regarding the value of beginning the teaching of reading in the kindergarten. The first grade findings are reported in the section which follows.

FIRST GRADE RESULTS

Data were gathered during first grade by several means. During October 1961, the Kuhlmann-Anderson Test, Form A was administered to all first grade youngsters included in the study. The IQ scores and mental ages obtained were used as control variables in the first grade.

In May 1962, the Gates Primary Test and the Gates Advanced Primary Reading Tests were administered. Trial with an experimental group outside the main study had indicated the need for use of the two tests since the primary reading test had a ceiling that was too low for the better readers and the advanced primary had a base too high for the control group. In order to overcome these limitations both tests were given to the groups in the study. The scores from each test were added together and a total combined score was obtained. This total combined score was that upon which the first grade results in Table II were based.

Scores from the evaluative instruments were analyzed by the covariance technique. This method adjusted the scores to account for initial differences between groups on variables which were related to performance such as intelligence and age. In this way, groups were in effect, statistically equated.

Effect of Kindergarten Reading Instruction

An important question which the research sought to answer was:

- What effect did beginning the teaching of reading in the kindergarten have upon subsequent first grade achievement?

The results can be seen in Table II.

TABLE II

EFFECT OF KINDERGARTEN READING INSTRUCTION ON FIRST GRADE READING ACHIEVEMENT

Group	Gates Reading Tests Adjusted Test Score Mean	Level of Significance
Group I (Control) Regular Kindergarten Regular First Grade	960	< .001
Group II (Delayed-Experimental) Regular Kindergarten Adjusted First Grade	1041	
Group III (Short-term Experimental) Experimental Kindergarten Regular First Grade	1074	
Group IV (Experimental) Experimental Kindergarten Adjusted First Grade	1181	

The differences shown from one group to the next were statistically significant at the .001 level. These results were adjusted through covariance analysis to allow for differences between groups in IQ, mental age, and chronological age. All of the scores which follow have been treated in this way. Analysis of the adjusted test scores in Table II showed that:.

1. The children who had the beginning reading activities in kindergarten scored significantly better at the end of first grade than did the children who had the regular kindergarten program.

2. Optimum reading achievement was obtained when adjustments were made in the first grade program to take advantage of gains made in the kindergarten.

3. The time of introduction of the beginning reading activities had a significant effect on achievement. Those children who were taught the experimental materials in kindergarten were significantly better readers than those children who began the same method in the first grade.

These differences reported were significant beyond the .001 level of confidence.

Summary

Kindergarten children did learn the skills basic to beginning reading. Furthermore, these skills helped in achieving higher reading scores at the end of first grade. The scores at the end of the first grade indicated clearly that the best results were obtained when adjustments were made in the first grade program to take advantage of the gains made in kindergarten.

The time of introduction of the experimental instruction had a significant effect on achievement. Those children who received that instruction in the kindergarten were better readers at the end of first grade than those who received it in the first grade.

Thus, at the end of two years, the boys and girls who were taught beginning reading in the kindergarten had significantly higher achievement in reading, as measured by the Gates Primary Reading Tests, than did pupils who were taught reading in the first grade.

An analysis of the related effects revealed that:

1. Girls in each group learned more than boys. The overall difference in adjusted mean scores was 94. Differences within each treatment group did not differ significantly from this.

2. A positive correlation of .58 was found between mental age and reading achievement.

3. Categorization by chronological age had no significant effect on achievement. The greatest difference between CA groups was 4.57. This difference had a probability greater than .10 and must be attributed to chance.

4. There were no significant interactions, i.e., there were no inconsistencies which would cast doubt upon the findings. This supported the findings discussed previously.

Conclusions

Results at the end of two years of study appeared to establish an advantage for children who had an opportunity to learn elements of beginning reading in the kindergarten. Use of context and knowledge of letter names, sounds, and forms seemed to help children progress successfully when they began to read in books.

A practical implication would be the provision of appropriate possibilities for growth in reading in the kindergarten. Growth in reading is too important to be ignored or left to chance, incidental development. Results of the present study suggested that planning must occur if kindergarten-age children are to experience continuous growth in reading, concomitant with growth in other important areas. Experience has shown that such growth need not be at the expense of growth in other areas vital to a sound, balanced program of kindergarten instruction.

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Chapter VI

LONG RANGE EFFECTS

What can be said, as a result of the Denver research project, about the longitudinal effects of beginning the teaching of reading in the kindergarten? The findings, after several years of study, supported the importance of early beginning reading instruction for typical public school kindergarten children. The results emphasized the need for building upon an early start in reading. They tended to cast doubt upon predictions that early reading causes disabilities. Instead, the data suggested that several concomitant benefits resulted from beginning reading instruction in the kindergarten. These conclusions are discussed in the succeeding chapters.

In order to interpret correctly the data which are presented in the sections which follow, it is necessary that the functioning of the various research groups be understood. Since the groups were described in some detail in Chapter IV, only a brief statement concerning their roles is presented in this chapter.

Group I - The Control Group

Pupils in the control group (Group I) did not receive any of the experimental instruction described in Chapter III. Instead, they had only the instruction provided by the regular reading program described in Chapter III. They had no instruction in reading in the kindergarten and constituted the true control group.

Group II - The Delayed-Experimental Group

Pupils in this group (Group II) were also in the control group only in the kindergarten. In the early part of the first grade, they received the experimental instruction (the same instruction that the true experimental group had received in the kindergarten) and from then on they had the adjusted instructional program described in Chapter III. Because the presentation of the experimental method for this group was delayed until first grade, this group was called the delayed-experimental group.

Group III - The Short-Term Experimental Group

Pupils in this group (Group III) received the experimental reading instruction only in the kindergarten. They began reading in the kindergarten, but the early start was not followed-up. In the first and later grades they received the instruction provided by the regular program described in Chapter III. This group was designated the short-term experimental group.

Group IV - The Experimental Group

Pupils in Group IV constituted the full-term experimental group. They received the experimental instruction in the kindergarten and in the subsequent grades, they were given the instruction provided by the adjusted program. This group was referred to as the experimental group.

At the conclusion of the study, the control group (Group I) had two hundred and twenty-five pupils; the delayed-experimental group (Group II) had four hundred and ninety-six children; the short-term experimental group (Group III) had seven hundred and seven boys and girls; and the experimental group had seven hundred and fifty-nine pupils remaining. In considering the data, it will be helpful to recall that the entry requirement for kindergarten was that a child must have been five-years-old before November 30th. Thus, although some pupils gained entry before that age by means of special testing, most kindergarten pupils were five years of age.

Because of the direct relationship between early reading instruction and later reading achievement, the groups were first compared on the basis of total reading achievement. That is, the sub-sections of the test pertaining to reading, such as word meaning, paragraph meaning, and the like were combined to obtain a total reading score. These adjusted total test score means have been computed to two decimal places, the number rounded and the decimal point omitted in the tables. This reporting procedure was based upon that suggested by Diederich. [1] The data reported have been examined by covariance analysis. Variables considered include age, IQ, sex, and family background.

Have the initial gains of the groups which began reading in the kindergarten been maintained in later years?

The real significance of the initial gains made by the experimental groups, as reported in Chapter V, depended upon the permanence of this early achievement. For purposes of comparison, the achievement of Group I provided a useful base against which the progress of the other groups could be measured. It served as the control group, and had a typical kindergarten program followed in the first and later grades by the regular program in reading. Group IV, it will be recalled, was the true experimental group, having had the experimental program in kindergarten and an adjusted program in the first and later grades to take advantage of any gains made in the kindergarten. The achievement of these groups is compared in Table III.

TABLE III

COMPARATIVE READING ACHIEVEMENT OF EXPERIMENTAL AND CONTROL GROUPS

Test and Grade Administered	Treatment Group	Adjusted Test Score Mean	Group Difference	Group Difference Favors	Level of Significance
Grade 2					
Stanford Primary Form N	Control (Group I)	585	52	Group IV	$< .001$
	Experimental (Group IV)	637			
Grade 3					
Stanford Primary II Form W	Control (Group I)	679	108	Group IV	$< .001$
	Experimental (Group IV)	787			
Grade 4					
Stanford Int. I Form W	Control (Group I)	586	186	Group IV	$< .001$
	Experimental (Group IV)	772			
Grade 5					
Stanford Int. II Form X	Control (Group I)	571	157	Group IV	$< .001$
	Experimental (Group IV)	728			

Permanence of Initial Gains

On the basis of these data, it was clear that the measurable advantages of an early introduction to reading tended to persist over a fairly extended period of time. When appropriate adjustments were made in later grades, the initial gains, which occurred as a result of beginning reading in the kindergarten, were maintained through the fifth grade.

Would the initial gains have continued if no adjustments had been made in subsequent reading instruction?

The design of the study permitted more subtle comparisons between groups than would have been the case if only an experimental and control group had been used. The curricular variations followed by the groups provided a basis for important findings. For example, with this kind of grouping, it was possible to learn how persistent were advantages due to an early start in reading when no special follow through was attempted. The influence of the adjusted reading program can be seen in Table IV.

TABLE IV

COMPARATIVE READING ACHIEVEMENT OF EXPERIMENTAL AND SHORT-TERM EXPERIMENTAL GROUPS

Test and Grade Administered	Treatment Group	Adjusted Test Score Mean	Group Difference	Group Difference Favors	Level of Significance
Grade 2					
Stanford Primary Form N	Short-term Exp. (Group III)	585	52	Group IV	$< .001$
	Experimental (Group IV)	637			
Grade 3					
Stanford Primary II Form W	Short-term Exp. (Group III)	678	109	Group IV	$< .001$
	Experimental (Group IV)	787			
Grade 4					
Stanford Int. I Form W	Short-term Exp. (Group III)	591	181	Group IV	$< .001$
	Experimental (Group IV)	772			
Grade 5					
Stanford Int. II Form X	Short-term Exp. (Group III)	575	153	Group IV	$< .001$
	Experimental (Group IV)	728			

Need for Adjustment

The necessity for adjustment in the subsequent reading program of those boys and girls who were taught beginning reading in the kindergarten appears to have been established. Children in the experimental group whose introduction to reading was subsequently followed by an adjustment reading program demonstrated achievement significantly higher than pupils in the short-term experimental group whose early start in reading was not followed-up.

The case for following through after an early start in reading was strengthened when the achievement of the short-term experimental group was compared with that of the control group as in Table V.

TABLE V

COMPARATIVE ACHIEVEMENT OF CONTROL GROUP AND SHORT-TERM EXPERIMENTAL GROUP

Test and Grade Administered	Treatment Group	Adjusted Test Score Mean	Group Difference	Group Difference Favors	Level of Significance
Grade 2					
Stanford Primary Form N	Control (Group I)	585	0	-	NS
	Short-term Exp. (Group III)	585			
Grade 3					
Stanford Primary II Form W	Control (Group I)	679	1	Group I	NS
	Short-term Exp. (Group III)	678			
Grade 4					
Stanford Int. I Form W	Control (Group I)	586	5	Group III	NS
	Short-term Exp. (Group III	591			
Grade 5					
Stanford Int. II Form X	Control (Group I)	571	4	Group III	NS
	Short-term Exp. (Group III)	575			

It can be seen from this table that initial advantage of an early start in reading, when not capitalized upon, had been lost by the end of the second grade. Since the kindergarten and first grade data reported in Chapter III showed that the short-term experimental group had made statistically significant gains over the control group in kindergarten and first grade, it was learned that this initial advantage disappeared sometime during the second grade when no adjustments were made in the subsequent reading program. That this need not have happened was shown by the significance of the long term gains demonstrated by the experimental group which had the early reading supplemented by an adjusted program in later years.

Another way of stating this is that an early start in reading will not last beyond the first grade unless the reading program in subsequent years capitalizes upon this early start. Perhaps, this lack of planned maintenance of initially developed skills is the reason why so many longitudinal studies report no significance when children are measured several years after an experimental treatment. In light of the evidence, it is apparent that if children are taught beginning reading in the kindergarten, suitable adjustment in later reading programs must be made or the initial advantage which persisted through kindergarten and first grade will be lost.

Was the superior achievement of the group which began reading in the kindergarten due to an early start in reading or to later acceleration?

It was important to further determine the effect of the adjusted or accelerated programs upon reading. If this was not done, it would be difficult to determine whether later reading achievement was due to an early start in reading or to the subsequent acceleration. Inclusion in the study of the delayed-experimental group made possible this assessment. When its achievement was compared with that of the true experimental group, the major difference between groups was the time reading was begun. Both groups had an accelerated program. In this way, the effect of the adjusted or accelerated program was isolated. The relative achievement of these groups is shown in Table VI.

TABLE VI

COMPARATIVE ACHIEVEMENT OF EXPERIMENTAL AND DELAYED-EXPERIMENTAL GROUP

Test and Grade Administered	Treatment Group	Adjusted Test Score Mean	Group Difference	Group Difference Favors	Level of Significance
Grade 2					
Stanford Primary Form N	Delayed-Exp. (Group II)	617	20	Group IV	< .03
	Experimental (Group IV)	637			
Grade 3					
Stanford Primary II Form W	Delayed-Exp. (Group II)	705	82	Group IV	< .001
	Experimental (Group IV)	787			
Grade 4					
Stanford Int. I Form W	Delayed-Exp. (Group II)	624	148	Group IV	< .001
	Experimental (Group IV)	772			
Grade 5					
Stanford Int. II Form X	Delayed-Exp. (Group II)	597	131	Group IV	< .001
	Experimental (Group IV)	728			

Consideration of the scores of these two groups shows that the achievement of the experimental group was significantly higher for each of four years, Grades 2-5, than that of the delayed-experimental group. Thus, when the effect of acceleration was controlled, it can be seen that kindergarten beginning reading instruction was the primary factor in producing the high level of achievement of the experimental group.

Power of Acceleration

Nevertheless, the acceleration which occurred in the adjusted reading program was a powerful force. Children in the delayed-experimental group who had an adjusted program in the first and later grades, demonstrated significantly higher achievement than did children in the control group who had a total six-year regular program. This is illustrated in Table VII.

TABLE VII

COMPARATIVE ACHIEVEMENT OF THE CONTROL AND
DELAYED-EXPERIMENTAL GROUP

Test and Grade Administered	Treatment Group	Adjusted Test Score Mean	Group Difference	Group Difference Favors	Level of Significance
Grade 2					
Stanford Primary Form N	Control (Group I)	585	32	Group II	< .01
	Delayed-Exp. (Group II)	617			
Grade 3					
Stanford Primary II Form W	Control (Group I)	679	26	Group II	< .05
	Delayed-Exp. (Group II)	705			
Grade 4					
Stanford Int. I Form W	Control (Group I)	586	38	Group II	< .02
	Delayed-Exp. (Group II)	624			
Grade 5					
Stanford Int. II Form X	Control (Group I)	571	26	Group II	< NS
	Delayed-Exp. (Group II)	597			

The performance of these two groups suggested that even when reading was not introduced until first grade, the reading attainment of boys and girls was improved substantially by means of the experimental, accelerated reading program.

The real impact of acceleration upon reading achievement was seen when the relative performance of the delayed-experimental group and of the short-term experimental group was examined. Initially, as reported in Chapter V, the kindergarten reading of the short-term experimental group resulted in significantly higher attainment than was the case for the delayed-experimental group. However, during the second grade, the adjusted program of the delayed-experimental group enabled it to surpass the reading achievement of the short-term experimental group, which had no acceleration after the kindergarten reading. This is disclosed in Table VIII.

TABLE VIII

COMPARATIVE ACHIEVEMENT OF DELAYED-EXPERIMENTAL GROUP AND SHORT-TERM EXPERIMENTAL GROUP

Test and Grade Administered	Treatment Group	Adjusted Test Score Mean	Group Difference	Group Difference Favors	Level of Significance
Grade 2					
Stanford Primary Form N	Delayed-Exp. (Group II)	617	32	Group II	< .01
	Short-term Exp. (Group III)	585			
Grade 3					
Stanford Primary II Form W	Delayed-Exp. (Group II)	705	27	Group II	< .03
	Short-term Exp. (Group III)	678			
Grade 4					
Stanford Int. I Form W	Delayed-Exp. (Group II)	624	33	Group II	< .04
	Short-term Exp. (Group III)	591			
Grade 5					
Stanford Int. II Form X	Delayed-Exp. (Group II)	597	22	Group II	NS
	Short-term Exp. (Group III)	575			

Total Reading Achievement Summarized

In summary, the data in the preceding tables indicated that:

- Kindergarten reading instruction had a measurable, lasting effect when adjustments were made in subsequent instruction to enable a child who had the advantage of beginning reading in kindergarten to capitalize upon this learning.

- Optimum reading achievement was obtained by those boys and girls who received beginning reading instruction in kindergarten and who had an adjusted reading program in later grades. Without such adjustment, the measurable advantages of early reading instruction faded by the end of the third year.

- Acceleration or adjustment of the reading program was also an effective means of improving reading achievement. At the conclusion of the study, those boys and girls who had an adjusted or stepped-up program of reading instruction following their introduction to reading in the first grade occupied the second most favorable position in terms of reading achievement.

Did the early introduction to reading produce larger reading vocabularies?

When the total reading scores of the classes are analyzed in terms of the sub-tests which comprise them, a definite pattern is found. The word meaning scores are shown in Tables IX and X.

TABLE IX

THIRD GRADE READING VOCABULARY
WORD MEANING

Means of Groups Compared Stanford Achievement Test		Difference in Means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Experimental (Group IV) 305	Control (Group I) 261	44	5.47	7.980	$< .001$	IV
Experimental (Group IV) 305	Delayed-Exp. (Group II) 269	36	3.78	9.638	$< .001$	IV
Experimental (Group IV) 305	Short-term Experimental (Group III) 269	36	4.55	7.980	$< .001$	IV

TABLE X

FIFTH GRADE READING VOCABULARY
WORD MEANING

Means of Groups Compared Stanford Achievement Test		Difference in Means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Experimental (Group IV) 314	Control (Group I) 235	79	6.62	11.828	$< .001$	IV
Experimental (Group IV) 314	Delayed-Exp. (Group II) 252	62	4.87	12.571	$< .001$	IV
Experimental (Group IV) 314	Short-term Experimental (Group III) 241	73	4.62	15.773	$< .001$	IV
Delayed-Exp. (Group II) 252	Control (Group I) 235	17	7.18	2.379	$< .05$	II
Delayed-Exp. (Group II) 252	Short-term Experimental (Group III) 241	11	5.38	2.165	$< .05$	II

At the end of the third and fifth grades, the experimental groups had better reading vocabularies as indicated by the word meaning test than any of the other groups. The influence of reading beyond typical grade levels was demonstrated by the delayed-experimental group. This group which had the accelerated reading program, after being taught reading in the first grade, occupied the second most favorable position.

Was the reading comprehension of the experimental group noticeably better than that of the other groups?

The greater reading comprehension of the experimental group became apparent when the paragraph meaning portions of the test were analyzed. The reading comprehension of this group significantly surpassed that of all other groups in both grades three and five. It certainly appears that the experimental kindergarten instruction was related to high levels of reading comprehension in later grades. These figures can be seen in Tables XI and XII.

TABLE XI

THIRD GRADE READING COMPREHENSION
PARAGRAPH MEANING

Means of Groups Compared Stanford Achievement Test		Difference in Means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Experimental (Group IV) 484	Control (Group I) 420	64	9.49	6.751	$< .001$	IV
Experimental (Group IV) 484	Delayed-Exp. (Group II) 437	47	6.64	7.156	$< .001$	IV
Experimental (Group IV) 484	Short-term Experimental (Group III) 410	74	8.73	8.467	$< .001$	IV
Delayed-Exp. (Group II) 437	Control (Group I) 420	17	9.93	1.667	$< .05$	II
Delayed-Exp. (Group II) 437	Short-term Experimental (Group III) 410	27	9.21	2.866	$< .01$	II

TABLE XII

FIFTH GRADE READING COMPREHENSION
PARAGRAPH MEANING

Means of Groups Compared Stanford Achievement Test		Difference in Means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Experimental (Group IV)	Control (Group I)					
414	335	79	8.71	9.065	$< .001$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)					
414	344	70	6.51	10.770	$< .001$	IV
Experimental (Group IV)	Short-term Experimental (Group III)					
414	334	80	6.17	13.045	$< .001$	IV

Other differences between groups were not significant.

It was interesting to note that at the end of the third grade the delayed-experimental group had a level of reading comprehension exceeded only by that of the experimental group. However, at the completion of the study, the only significant differences in reading comprehension favored the true experimental group.

From these data, it was seen that the experimental group which began reading in the kindergarten had the highest level of attainment in the areas of reading vocabulary and reading comprehension. Two factors seem to be associated with this achievement; beginning reading in the kindergarten and appropriate acceleration in later years.

Was the rate at which children read affected by early reading instruction?

The relationship between an early start in reading and the rate at which children read was examined in the third and fifth grades. The rate was measured by the speed section of the Gates Reading Survey. During Grade 3, it was found that the experimental group read at a significantly higher rate than each of the other groups. This can be seen in Table XIII.

TABLE XIII

THIRD GRADE GATES READING SURVEY
SPEED OF READING

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group P Favors
Experimental (Group IV)	Control (Group I)	15	6.83	2.152	$< .02$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	8	5.10	1.647	$< .05$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	13	5.69	2.265	$< .02$	IV

Other differences between groups were not significant.

A slightly different picture emerged at the end of fifth grade. The children in the experimental group who had the kindergarten reading and an adjusted program in later grades, read at a rate significantly higher than did control group children. They also read significantly faster than did their early reading counterparts, the short-term experimental group, who did not have an accelerated reading program in the later grades. However, by the end of Grade 5, they did not read significantly better than those delayed-experimental group children who began reading in the first grade and who then had accelerated reading instruction. These figures are given in Table XIV. These results would seem to suggest that both early reading instruction and an accelerated reading program influenced reading rates.

TABLE XIV

FIFTH GRADE GATES READING SURVEY
SPEED OF READING

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group P Favors
Experimental (Group IV)	Control (Group I)	33	9.23	3.519	$< .001$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	25	8.93	2.722	$< .01$	IV

Other differences between groups were not significant.

READING ACHIEVEMENT SUMMARIZED

What then can be said, in light of these data, about longitudinal effects of an early start in reading upon later reading achievement?

The findings suggest that:

- the experimental kindergarten beginning reading program resulted in significantly high levels of reading achievement.
- the superiority of the experimental early reading group was maintained over a period of several years; it included significant achievement in reading vocabulary and in reading comprehension. Some gains in reading rate were also evident.
- maximum achievement was attained when gains made as a result of the experimental kindergarten beginning reading program were capitalized upon through an accelerated reading program in succeeding years.
- kindergarten beginning reading instruction must be followed by an adjusted reading program which builds upon advantages gained as a result of the early start in reading. When the subsequent adjustment was lacking, the kindergarten reading disappeared sometime during the second grade.

To summarize, the seeds of beginning reading can be planted successfully in the kindergarten. With appropriate nourishment, they will grow and flourish; they must be cultivated if they are to be maintained.

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Chapter VII

ACADEMIC ACHIEVEMENT EXAMINED

During the course of the study, achievement in certain other subjects was tested. Scores were obtained in areas such as arithmetic, reading, science, study skills, and social studies. These were analyzed to determine patterns of differences which may have developed between the control and experimental groups. The tests used were the Stanford Achievement Tests. The specific form administered at each grade level can be seen in the Testing Schedule on page 40. The findings are presented in the paragraphs which follow. They help to answer the question:

Did beginning the teaching of reading in the kindergarten affect academic achievement in later years?

Word Study Skills

The achievement tests administered during the third and fourth grades yielded a score for word study skills. In the Stanford Primary II Battery, the word study skills consisted of two parts. Part A tested perception of beginning and ending sounds. Part B required the matching of the same sound in words when the same sound was represented by different spellings. The word study skills were closely related to reading and might have been expected to reflect somewhat the same differences as reported in the reading achievement section. This appeared to have been the case. The children in the experimental group who had the kindergarten reading program, followed by acceleration in later groups, demonstrated achievement significantly higher than the other groups of children. This result may have been due to the emphasis in the kindergarten upon phonic elements such as letter-sound associations, beginning sounds, and the like. The succeeding accelerated reading program appeared to have aided in the maintenance of these skills.

TABLE XV

THIRD GRADE COMPARATIVE ACHIEVEMENT IN WORD STUDY SKILLS

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Experimental (Group IV)	Control (Group I)	72	9.81	7.305	$< .001$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	58	7.16	8.054	$< .001$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	73	8.94	8.163	$< .001$	IV

Other differences between groups were not significant.

The Stanford Achievement Tests given in the third and fourth grades provided a measure of word study skill. According to the test manual, the phonics section measured the ability to use phonic patterns in word recognition, while the syllabication section measured the ability to see word structure. Once again, at the fourth grade level the children with the experimental kindergarten reading experiences--followed by a subsequently accelerated reading program--had significantly higher achievement in word study skills than did children in each of the other groups. These data are shown in Table XVI.

TABLE XVI

FOURTH GRADE COMPARATIVE ACHIEVEMENT IN WORD STUDY SKILLS

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Experimental (Group IV)	Control (Group I)	82	9.93	8.211	<.001	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	66	6.63	9.977	<.001	IV
Experimental (Group IV)	Short-term Experimental (Group III)	86	9.45	9.138	<.001	IV

Other differences between groups were not significant.

Arithmetic

Achievement in arithmetic was measured to see if the experimental reading programs might have affected achievement in arithmetic. It was possible that children who read well would also have high scores in mathemetical areas where performance was dependent upon proficiency in reading. Similarly, it was also possible that there would be little, if any, difference in arithmetic computation which required less skill in reading. These ideas were examined.

Arithmetic Computation

When the arithmetic computation of the various groups was viewed, no clear cut picture emerged. Although the experimental pupils evidenced some superiority no consistent pattern has evolved with respect to arithmetic computation. It appeared that reading achievement was not directly related to arithmetic computation. These results are given in Table XVII.

TABLE XVII

COMPARATIVE ACHIEVEMENT IN ARITHMETIC COMPUTATION

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Grade 2						
There were no significant differences in Grade 2.						
Grade 3						
Experimental (Group IV)	Control (Group I)	36	11.37	3.152	$< .002$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	19	8.33	2.323	$< .02$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	38	10.31	3.689	$< .001$	IV
Grade 4						
Control (Group I)	Short-term Experimental (Group III)	22	8.53	2.549	$< .02$	I
Delayed-Exp. (Group II)	Short-term Experimental (Group III)	17	6.69	2.465	$< .02$	II
Experimental (Group IV)	Short-term Experimental (Group III)	18	6.81	2.565	$< .02$	IV
Grade 5						
Experimental (Group IV)	Control (Group I)	8	3.80	2.037	$< .05$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	9	3.18	2.767	$< .01$	IV
Short-term Experimental (Group III)	Delayed-Exp. (Group II)	7	3.03	2.488	$< .05$	III

Other differences between groups were not significant.

The arithmetic scores obtained in the sections of the test referred to as arithmetic concepts, applications, or reasoning usually involved some reading. It seemed logical to assume that achievement in these areas might be influenced by facility in reading. This assumption was only partially substantiated. In most cases where a significant difference existed, it was in favor of the experimental group or the delayed-experimental group. It might have been that the amount of reading required by the test was too small to affect greatly the arithmetic reasoning scores. The pertinent data are presented in Table XVIII.

TABLE XVIII

COMPARATIVE ACHIEVEMENT IN
ARITHMETIC REASONING

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Grade 2						
Experimental (Group IV)	Control (Group I)	7	2.76	2.674	< .01	IV
Experimental (Group IV)	Short-term Experimental (Group III)	8	2.66	3.094	< .01	IV
Delayed-Exp. (Group II)	Control (Group I)	5	2.83	1.915	< .05	II
Delayed-Exp. (Group II)	Short-term Experimental (Group III)	6	2.74	2.288	< .02	II
Grade 3						
Experimental (Group IV)	Control (Group I)	24	7.80	3.091	< .002	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	14	5.83	2.343	< .01	IV
Experimental (Group IV)	Short-term Experimental (Group III)	25	7.18	3.533	< .001	IV
Grade 4						
Experimental (Group IV)	Short-term Experimental (Group III)	12	12.38	2.056	< .05	IV
Delayed-Exp. (Group II)	Short-term Experimental (Group III)	13	5.90	2.141	< .05	II
Grade 5						
Experimental (Group IV)	Control (Group I)	9	3.91	2.340	< .05	IV
Experimental (Group IV)	Short-term Experimental (Group III)	7	2.88	2.604	< .01	IV

Other differences between groups were not significant.

Arithmetic Achievement Summarized

Differences in the comparative arithmetic computation of the groups in the study presented no conclusive evidence that early reading affected later performance in this area. However, it was interesting to note that in the area of arithmetic reasoning, which depended more on reading ability, the experimental and delayed-experimental groups were favored in every instance where significant differences were found.

Language

Reading skill is generally recognized as being dependent in a large measure upon facility in language. The data were inspected to determine whether the groups which had high levels of reading achievement had somewhat comparable language proficiency. Scores in language achievement were available for third, fourth, and fifth grades.

The results tended to support a relationship between reading and language skills at statistically significant levels during the third and fifth grades. No significant differences were found for the fourth grade. An explanation may lie in the fact that the tests used placed a great deal of emphasis on grammar, punctuation, capitalization, and other mechanical language skills. However, all that could be stated with certainty was that data for the third and fifth grades showed that the experimental group demonstrated significantly higher language achievement than did any of the other groups in the study. The achievement of these early reading children also was the highest of the groups compared in reading. The statistical information can be seen in Table XIX.

TABLE XIX

COMPARATIVE ACHIEVEMENT IN LANGUAGE

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Grade 3						
Experimental (Group IV)	Control (Group I)	25	9.64	2.603	$< .005$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	22	7.25	2.988	$< .002$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	29	8.48	3.404	$< .001$	IV
Grade 4						
There were no significant differences in Grade 4.						
Grade 5						
Experimental (Group IV)	Control (Group I)	125	11.96	10.484	$< .001$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	101	9.39	10.784	$< .001$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	104	8.91	11.690	$< .001$	IV

Other differences between groups were not significant.

Social Studies

Because reading skill is basic to the acquisition of knowledge in the social studies. it might have been expected that the study groups demonstrating high levels of reading achievement also would achieve highest in social studies. In general, this seemed to be so. Social studies test scores were available for fourth and fifth grades. When differences were noted, the experimental group tended to have significantly better achievement than the other groups. Because of the total picture given in Table XX, this finding needs to be interpreted with care.

TABLE XX

COMPARATIVE ACHIEVEMENT IN SOCIAL STUDIES

Groups Compared		Difference im means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Grade 4						
Experimental (Group IV)	Control (Group I)	19	7.51	2.475	$< .05$	IV
Grade 5						
Experimental (Group IV)	Control (Group I)	96	8.26	11.621	$< .001$	IV
Experimental (Group IV)	Delayed-Exp. (Group II)	80	6.04	13.288	$< .001$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	90	5.40	16.646	$< .001$	IV

Other differences between groups were not significant.

The fifth grade social studies achievement of the experimental group was significantly higher than that of all the other groups in the study. It is interesting to speculate concerning the reasons why this was so. The only significant difference at the end of fourth grade was the superior social studies achievement of the experimental group over the control group. Perhaps, at the fifth grade level, the influence of the adjusted program with its special material which emphasized interpreting factual material and adjusting reading rate to purpose affected the results. However, the delayed-experimental group had the same material but did not have the same level of achievement. The difference in achievement may well have required the early start in reading as well as the adjusted program. This seemed to have been indicated.

Science

Science is another area in which achievement may be partially dependent upon reading ability. This possibility was tested. Science scores were available for the intermediate grades. Due to the construction of the *Stanford Achievement Test* used, the results from the third grade represented a combined score for science and social studies concepts. In all cases where a significant difference existed it favored either the experimental group or the delayed-experimental group. The significant differences which existed suggested rather than confirmed a relationship between reading achievement and science performance. The actual figures are given in Table XXI.

TABLE XXI

COMPARATIVE ACHIEVEMENT IN SCIENCE

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Grade 3						
Delayed-Exp. (Group II)	Control (Group I)	18	5.42	3.297	$<.001$	II
Delayed-Exp. (Group II)	Short-term Experimental (Group III)	20	4.79	4.136	$<.001$	II
Experimental (Group IV)	Control (Group I)	17	5.44	3.107	$<.002$	IV
Experimental (Group IV)	Short-term Experimental (Group III)	19	4.82	3.909	$<.001$	IV
Grade 4						
Delayed-Exp. (Group II)	Control (Group I)	17	8.09	2.120	$<.05$	II
Experimental (Group IV)	Control (Group I)	17	8.33	2.004	$<.05$	IV
Grade 5						
Delayed-Exp. (Group II)	Short-term Experimental (Group III)	16	5.85	2.798	$<.01$	II
Experimental (Group IV)	Short-term Experimental (Group III)	13	5.24	2.383	$<.05$	IV

Other differences between groups were not significant.

Spelling

The spelling achievement scores collected showed a significant difference in favor of the experimental group and the delayed-experimental group at only the second grade level. The effect of the different reading procedures upon spelling achievement was apparently quite minimal. All groups spelled equally well in the intermediate grades. The figures for the second grade are contained in Table XXII.

TABLE XXII

COMPARATIVE ACHIEVEMENT IN SPELLING

Groups Compared		Difference in means	σ_{D_M}	Critical Ratio	P	Group Difference Favors
Grade 2						
Experimental (Group IV)	Control (Group I)	15	4.639	3.203	.001	IV
Delayed-Exp. (Group II)	Control (Group I)	15	4.735	3.227	.001	IV

Other differences between groups were not significant.

Summary

The relationship between proficiency in reading and achievement in some academic areas was measured. As might be expected, in those subjects in which academic achievement was dependent upon the reading of quantities of printed matter, the groups with the highest level of reading competence tended to excel significantly. Thus, the experimental group and the delayed-experimental group had significantly high levels of achievement in certain academic areas.

The pattern which has emerged probably should be considered to be indicative of possible relationships rather than conclusive. For example, the experimental group generally excelled significantly in the areas of word study skills, arithmetic concepts, language, and social studies and, to some extent, in science. Arithmetic computation and spelling achievement seemed to have been unaffected by reading performance. It appeared that a kind of academic "halo effect" was related to the accelerated kindergarten reading program. Children who were taught to read in the kindergarten; who had an adjusted program in the later grades designed to extend this early start in reading tended to perform better in other school subjects involving reading.

Chapter VIII

READING DISABILITIES

It was important to discover if the kindergarten reading program resulted in an increased incidence of reading disabilities. Prior to initiating the study, the materials and methods used were carefully screened. It was determined that experimental method would not require prolonged periods of near vision. Reading authorities were consulted, the research of ophthamologists examined, and the advice of school medical authorities sought in order to learn of potential hazards which might occur if reading were taught in the kindergarten. The conclusions which emerged, while not conclusive, were most reassuring. It was decided to proceed with the study while carefully checking at various stages of the project to detect any problems which might arise in critical areas.

Has teaching beginning reading in the kindergarten affected pupils' vision?

The vision of youngsters in the study was checked during the first, third, and fifth grades. Two measures were used: the routine visual screening performed by the school nurses and the number of children wearing glasses. Vision was considered to be deficient if the youngsters had a Snellen score greater than 20/40 or if they wore glasses. The limitations of these procedures for any one screening was recognized. It was thought that several such examinations, spread over a period of years, would yield reliable information. On the basis of the results which were obtained, it appeared that concerns voiced regarding children's eyesight were not substantiated. The vision of the classes which began reading in the kindergarten (Groups III and IV) was compared with that of the classes which were taught reading in the first grade (Groups I and II). It was found that both of the groups had virtually the same percentage of children exhibiting visual difficulties. A chi square test for differences in proportions indicated no statistically significant differences with respect to the percentage of children in each group who had sight defects. This seemed to indicate that the beginning reading taught in the kindergarten did not produce eye damage. The results are shown in Table XXIII.

TABLE XXIII

PERCENTAGES OF CHILDREN EXHIBITING VISUAL DEFECTS

	First Grade Beginning Reading Group I and Group II	Kindergarten Beginning Reading Group III and Group IV
Grade 1	6.2	6.9
Grade 3	13.3	12.5
Grade 5	30.2	26.0

Was children's hearing affected by the early reading instruction?

The acuity of children's hearing was checked by school audiologists. The purpose of this measurement was to see if beginning reading instruction in the kindergarten affected hearing perception. Two possibilities might occur. Children who were taught reading in the kindergarten might have become confused if their hearing hadn't developed sufficiently. It was also possible that the early reading instruction might have developed an awareness of sounds which would result in increases in the measurable levels of hearing acuity. The evidence obtained showed the hearing acuity appeared to have been unaffected by early reading. A chi square test showed the differences in proportions between groups was not significant. The figures are listed in Table XXIV.

TABLE XXIV

PERCENTAGES OF CHILDREN WITH HEARING LOSS

	First Grade Beginning Reading Group I and Group II	Kindergarten Beginning Reading Group III and Group IV
Grade 1	3.6	3.7
Grade 3	3.9	3.4
Grade 5	3.2	3.5

Did pupils who began to read in the kindergarten have problems of adjustment in later grades?

When the study began, cautions were voiced that beginning the teaching of reading in the kindergarten might provoke or prevent certain reading disabilities. Because of this, it was considered desirable to obtain evidence concerning children's mental health. In this way, it was possible to determine if the experimental early reading instruction caused maladjustment or emotional problems.

Standards were established by which the presence or absence of adjustment difficulties were judged. They were based upon information available from the Department of Social Work and Psychological Services. This information consisted of teacher referrals; projective tests such as the Thematic Apperception Test, the Draw-A-Person Test, and the like; child-case studies involving teachers, the school nurse, the principal, the school social worker, psychologists, and, in some cases psychiatrists. These data were collected for the duration of the study. It was thought that this information provided ample indication of serious adjustment problems that might have been caused either by the kindergarten reading or the accelerated reading program.

In the initial phases of the study, it was decided that the data pertaining to adjustment should be by discrete groups so that the effects upon mental health of acceleration, as well as of early reading, could be determined easily. This procedure has been followed. The results can be seen in Table XXV.

TABLE XXV

PERCENTAGES OF CHILDREN EXHIBITING
ADJUSTMENT PROBLEMS

	Group I (Control)	Group II (Delayed-Exp.)	Group III (Short-term Exp.)	Group IV (Experimental)
Grade 2	0.5%	0.6%	0.7%	0.3%
Grade 3	0.5	0.7	0.0	0.2
Grade 5	2.5	2.7	1.6	2.9

The percentage of children exhibiting adjustment problems in each group was too small to warrant a statistical test. It was quite proportional and seemed to indicate that teaching beginning reading in the kindergarten did not create adjustment problems.

Did an early introduction to reading affect children's attitude toward reading?

A direct method for getting at the interest and enjoyment of children in reading seemed to be the quantity of independent reading done by pupils. Commencing with the second grade, records were kept of the pupil's independent home or school reading during the school year. Although this was a gross measure, the data seemed to indicate that an early or accelerated reading program enhanced interest in reading for a period of several years. Significant differences were found during second, third, and fourth grades which favored the early reading or accelerated groups. However, during the first semester of fifth grade, no significant differences were apparent. These results suggested that when children succeeded in reading, they evidenced their enjoyment through the large number of books read. The percentages of children reading books in the various categories can be seen in Tables I through IV in Appendix A.

Were any areas of weakness or specific reading disabilities noted which could be attributed to early reading instruction?

When the study began, there was some concern about the possible effects of introducing beginning reading activities into the kindergarten. It was decided that diagnostic measures should be included in the evaluation in an attempt to detect any weakness in certain reading skills.

Several individual and group diagnostic instruments were considered by a panel including experienced reading supervisors, reading teachers, psychologists, and members of the research office staff. This group recommended the use of a recently developed Stanford Diagnostic Reading Test. It was constructed by well-known test-makers and could be administered to groups of children. Different forms were available for use at the third and fifth grade levels. The test was designed to pinpoint specific weaknesses in areas such as comprehension, auditory discrimination, blending, syllabication, sound recognition, and the like. The appropriate level of the test was administered to a sample of third and fifth grade students in the study. The administration dates can be seen in the testing schedule in Chapter IV.

An important point to be resolved was the selection for testing purposes of the subgroups within each research group. It seemed logical that children worthy of closer scrutiny would be those whose reading level was not as high as their expected level of achievement. This was determined by referring to a table of expected achievement prepared by the Office of Evaluation and Guidance of the Denver Public Schools. This table had been used for a number of years. It made use of two factors--IQ and number of months in school-- to determine the expected achievement level in terms of grade placement.

During the third grade, all children in the study who achieved below their expectancy level were selected for diagnostic testing. They comprised a subgroup which was fifteen percent of the total sample. This percentage was proportionally distributed throughout the research groups. The results of the diagnostic survey are shown in Table XXVI.

TABLE XXVI

THIRD GRADE MEANS OF GROUPS ON SUBSECTIONS
OF THE STANFORD DIAGNOSTIC READING TEST

Subsections of test	Control Group	Delayed-Exp. Group	Short-term Exp. Group	Experimental Group
Letter Names	220	215	214	216
Auditory Discrimination	292	290	296	293
Syllabication	107	100	100	102
Beginning Sounds	149	147	146	147
Ending Sounds	118	114	117	116
Blending	225	226	238	231
Sound Recognition	162	153	164	160

The differences between means on each of the subsections of the test as indicated in the table were not statistically significant. The slight differences may be attributed to chance variations.

On the basis of these scores, it may be concluded that there was no increase in reading disabilities due to the introduction of the skills basic to beginning reading in kindergarten. Apparently, the experimental beginning reading activities had neither a negative or positive effect on the number of children experiencing specific reading disabilities as measured in the third grade.

In the fifth grade a somewhat different procedure was followed for selection of pupils to be tested. A random subsample of 100 subjects from each group was examined, i.e., a total sample of 400 randomly selected pupils was tested. The Stanford Diagnostic Reading Test was administered to these children to evaluate competence in specific reading skills.

There were significant differences between groups on four of the five subsections of the Stanford Diagnostic Reading Test. For three of these sections; reading comprehension, vocabulary, and syllabication, significant differences existed. They were due to the higher achievement of the experimental group and of the delayed-experimental group as compared with the control group. In another section, blending, the significant difference was also due to the superiority of experimental group.

The results of this analysis at the fifth grade level also indicated that early introduction to reading had no adverse effect nor did it appear to cause specific reading disabilities in children. On the contrary, this evidence suggested that difficulties occurred less often in the experimental group. The results of the diagnostic testing are shown in Table XXVII.

TABLE XXVII

FIFTH GRADE MEANS OF GROUPS ON SUBSECTIONS OF THE STANFORD DIAGNOSTIC READING TEST

Subsections of test	Control Group	Delayed-Exp. Group	Short-term Exp. Group	Experimental Group
Reading Comprehension	328	372*	354	375*
Vocabulary	252	274*	262	280*
Syllabication	159	180*	168	171#
Sound Discrimination	260	269	265	282
Blending	157	172	184	202*

* Indicates scores which were significantly higher than the control group scores beyond the .01 level of confidence.

# Indicates scores which were significantly higher than the control group scores beyond the .05 level of confidence.

Analyses of Variance and Covariance

Over 150 analyses of variance and covariance were run. The analyses consisted basically of a two dimensional analysis of covariance with treatment as the primary independent variable and sex as the secondary independent variable. In each case, IQ was included as a control variable. This design was chosen to isolate the effects of sex, a variable which does not qualify as a covariate because of its discrete nature, and to adjust the results for differences in ability as indicated by the IQ score.

Other configurations were examined to determine the effects of other independent variables and possible interaction; however, in no case did the further analyses tend to contradict or weaken the results of the basic analyses. Some of the patterns which emerged are reported in the succeeding paragraphs.

What was the relative achievement of boys and girls?

When the achievement of boys was compared to that of girls, some definite patterns emerged.

The changing relationship in achievement of boys and girls has been an interesting development. During the first three years of study, the girls consistently achieved significantly higher in all subject areas evaluated. During the latter two years, there was a shift in this relationship in some areas.

At the end of the third grade there were no significant differences between the achievement of boys and girls in five of the areas tested by the Stanford Achievement Test. These five areas were word meaning, paragraph meaning, word study skills, language, and arithmetic computation. Boys achieved significantly higher than girls in science and social studies concepts and in arithmetic concepts. Girls achieved significantly higher than boys in spelling.

At the end of the fourth grade, the pattern was similar. However, the girls had gained a significant lead over boys in word study skills and language as well as maintaining their advantage in spelling. Boys performed significantly higher than girls in arithmetic concepts, arithmetic applications, social studies, and science. There were no significant differences between boys and girls in achievement in word meaning, paragraph meaning, and in arithmetic computation.

At the end of fifth grade there were significant differences between the achievement of boys and girls in all but one of the nine areas tested by the Stanford Achievement Test. Boys achieved significantly higher than girls in five areas: word meaning, arithmetic concepts, arithmetic applications, social studies, and science. Girls achieved significantly higher in three areas: spelling, language, and arithmetic computation. There was no significant difference in achievement in paragraph meaning.

Although there were some differences in the patterns in the third, fourth, and fifth grade years, there was also a consistency which indicated that the girls maintained a superiority in the facility with words and that the boys had achieved significantly higher in the arithmetic and science areas. The processes of acculturation seemed to be at work. Boys and girls appeared to be assuming the roles which society had established as appropriate for them.

How did the family background variables influence the performance of boys and girls in the study?

The relationships between certain background variables and achievement were examined. Observation of results revealed that there were positive relationships between achievement and the background variables of father's occupation, father's education, and the number of children in the family. These variables, however, were not independent of each other and for this reason no conclusions were drawn concerning a cause and effect relationship between these variables and achievement. One line of thought suggested that all three of these variables were components of a more inclusive and basic condition which might be labeled "an environment which nourishes learning."

The achievement of children whose fathers' education and occupation were classified as high was consistently and significantly above the achievement of those children whose fathers were classified as low on these characteristics. In most areas of achievement, the difference was statistically significant beyond the .001 level of confidence, leaving little doubt that a positive relationship existed. The relationship of family size and achievement was less clear-cut. The achievement of children classified on the basis of this characteristic did not yield a significant difference in a one-way analysis of covariance with IQ utilized as a control variable. However, in every area of achievement, there was a consistent pattern in which the children from smaller families achieved higher. The probability of this pattern being repeated nine times, once for each section of the test, was very low and this fact was highly suggestive that family size was a component of or associated with an educationally nourishing milieu.

The achievement of children did not seem to have been related to the age of their father, and since the ages of parents were closely related, there was no evidence to indicate that parental age influenced the performance of their children. Perhaps, it should be pointed out here that relationships just discussed were true of large groups of children, and there were many individual cases which varied considerably from the overall findings.

What was the effect of chronological age upon achievement?

This study was concerned with children within one grade level and thus the range of chronological ages was restricted. Some differences in achievement occurred even within this restricted range, however.

In kindergarten, the older children scored slightly, but significantly, higher than their younger classmates. As the children grew older, unadjusted scores reflected no significant differences, indicating that as the differences in ages became increasingly a smaller percentage of their total age, its effect became negligible.

What was the influence of IQ on achievement?

The relationship between IQ and achievement was consistently high as could be expected. Each year, after IQ scores became available, the achievement scores were examined in a two dimensional analysis with treatment group and course IQ groupings as the two independent variables. An important finding resulted from this analysis. In no case was there a significant interaction between the instructional program and IQ. This indicated that all ability groups profited proportionately as much by the early reading experience.

Summary

The findings reported in this section are reassuring. No significant evidence has been noted which would support the belief that the experimental early reading instruction caused reading disabilities. Undoubtedly, this hazard exists. The nature of the early reading instruction, no doubt, plays a major role in determining whether reading disabilities occur. It is quite possible that inappropriate, fatiguing beginning reading instruction which demanded long periods of near vision could harm children physically or emotionally. The results of the present study strongly support the position that early reading instruction can be given without causing reading disabilities.

This investigation checked the possibility that the early teaching of reading might cause an increased incidence of problems related to vision, hearing, social, or academic adjustment. Each of the four groups in the study had quite similar percentages of children who (1) had visual difficulties which necessitated the wearing of glasses, (2) a hearing loss, and (3) adjustment problems. This seemed to indicate that experimental early introduction to reading did not affect the number of pupils exhibiting physical disabilities or adjustment problems. It appeared that the teaching of reading in the kindergarten neither created or prevented problems in these important areas, since the differences found between the groups were not significant.

Chapter IX

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

SUMMARY

This study investigated the effectiveness of beginning the teaching of reading in kindergarten. The longitudinal effects as well as the initial results were examined. The progress of the children in the study was followed from the kindergarten through the fifth grade.

The population sample consisted of approximately 4,000 pupils who were randomly assigned by school to comparable control and experimental groups for kindergarten instruction. The kindergarten instruction of the control and experimental group was similar except for one major difference. The children in the experimental kindergarten groups were given instruction in the beginning reading activities for 20 minutes a day. The children in the control group followed the regular kindergarten program which was quite typical of those in many parts of the country. The experimental kindergarten children received planned, sequential instruction in beginning reading, while the control kindergarten children had activities which incidentally developed reading readiness.

When the children in the study entered the first grade, the experimental and control groups were in turn divided into two groups. This division provided four first grade groups:

Group I - The Control Group

Regular program in kindergarten
Regular program in the first and later grades

Group II - The Delayed-Experimental Group

Regular program in kindergarten
Experimental program in the first grade
Adjusted program in the first and later grades

Group III - The Short-term Experimental Group

Experimental program in kindergarten
Regular program in the first and later grades

Group IV - The Experimental Group

Experimental program in kindergarten
Adjusted program in the first and later grades

Group I provided a useful base against which to compare other groups. Group II permitted a comparison between groups who received the same instruction introduced at different times. Group III made possible the assessment of the effect of introducing reading in kindergarten when a regular reading program was provided in the first and following grades. Group IV followed an experimental program in kindergarten and a program in first grade adjusted to be consistent in approach with the kindergarten program and accelerated to take advantage of gains made in kindergarten. All groups had the same amount of reading instruction.

The regular reading program referred to on the previous page was that in use prior to the study. It was the reading program detailed in the Denver Public School Reading Guide[1], and was similar to those programs suggested in teachers' manuals of most basal texts. The adjusted program had two characteristics; (1) it was modified to continue use of the experimental technique with adopted basal readers, and (2) it provided for their use at an accelerated pace. Both the experimental and regular reading programs were supplemented by extensive use of library books.

Throughout the study, the principal statistical technique was analysis of variance: covariance technique. The primary variable considered was the time of beginning reading; other variables were mental age, chronological age, sex, IQ, and family characteristics. These latter variables were also used as covariates.

Comparisons were made on the criterion variable (reading achievement) between experimental groups and combinations of groups. Effects of other variables were studied in the same way. Analysis of variance also allowed computation of the interaction between variables. A separate analysis of this type was made with mental age, chronological age, sex, IQ, family characteristics, each used as the independent variable. In every case, attention was given to the interaction of the treatment variable (time of beginning reading) with the other variables in determining the effect of the criterion variable (reading achievement, and the like).

FINDINGS

The findings were:

1. Beginning reading skills can be taught quite effectively to large numbers of typical kindergarten pupils.

    - Specifically, public school kindergarten children were able to identify words by using together the beginning sound and context. The pupils also learned phonic elements such as letter names, letter forms, and letter-sound associations.

2. The permanence of gains made as a result of being taught beginning reading in the kindergarten depended upon subsequent instruction. Adjustments in the educational program which followed the teaching of kindergarten beginning reading were necessary if the initial gains were to be maintained.

   . Optimum reading achievement was obtained by boys and girls who received the experimental beginning reading instruction in kindergarten and who had an adjusted reading program in later grades. Such adjustment was necessary for the measurable advantages of early reading instruction to be preserved beyond the second grade. When the advantages of an early start in reading were followed-up, statistically significant gains in reading achievement persisted throughout the entire study.

3. The gains from the experimental program were evident in both reading comprehension and reading vocabulary. When the reading achievement of the groups in the study was analyzed, it was noted that the accelerated kindergarten beginning reading group had significantly higher levels of reading comprehension than any of the other groups. They had the most effective reading vocabularies of all groups studied and were most able to read with understanding.

4. The results showed that the accelerated kindergarten beginning reading group had significantly higher reading rates; they read with greater speed than any of the other groups when tested at the end of third grade. When evaluated in the fifth grade their reading speed was equalled only by the other accelerated group.

5. Acceleration or adjustment of the reading program was also an effective means of improving reading achievement. At the end of the study, those boys and girls who had an adjusted or stepped-up program of reading instruction following their use of the experimental instruction in the first grade, rather than in the kindergarten, occupied the second most favorable position in terms of reading achievement.

6. Beginning the teaching of reading in the kindergarten influenced achievement in other areas where success was dependent upon reading proficiency. This relationship was noted in the areas of word study skills, language, and the social studies.

7. All groups in the study seemed to profit from the additional emphasis on reading. The number of books read independently by all groups was quite impressive. During the first four grades of the investigation, the early kindergarten reading

and the accelerated reading groups had the highest percentages of children reading the greatest number of books.

8. The experimental instruction used in the study, i.e., the kindergarten program and the adjusted program used in later grades, proved to be more effective than the regular reading program with which it was compared.

9. No evidence was found that the experimental early instruction in beginning reading affected visual acuity, created problems of school adjustment, or caused dislike for reading. No statistically significant differences existed between groups in these areas.

10. It has been shown that through educational innovation a large urban public school system can significantly up-grade the reading achievement of boys and girls.

CONCLUSIONS

Research has established that boys and girls can be taught to read at earlier ages than they generally are. This fact is commonly recognized by reading authorities. That most children are not taught to read before the age of six years and six months may be attributed to two factors; tradition, and fear of harmful results.

Tradition

The traditional influences have been mentioned earlier. They consist of the older research, such as that of Morphett and Washburne [2] and others which suggested a mental age required for reading. When this age was cited, it was taken out of context. It was mentioned independently, and little attention was paid to the nature of the instructional methods and materials being used at the time. Nevertheless, because that beginning mental age coincided with entry into first grade, it came to be widely accepted in this country; a tradition which has been reinforced by the reluctance of kindergarten authorities to actively question it.

The influence of certain movements during recent decades has tended to assign kindergartens the responsibility for promoting children's social and emotional growth through informal play experiences. In the intellectual areas, the kindergarten has come to be given a readiness function. Results of several investigations [3,4,5,6] tended to show the efficiency with which these tasks were accomplished in the kindergarten. In the process, however, a tradition was being established. Two worthwhile objectives tended to become dominant: fostering physical development through play experiences and developing social and language skills by means of informal activities. The kindergarten came to contribute little to mental or academic development beyond a not-too-clearly defined concept of "readiness".

Thus, over a period of years, the kindergarten came to be a place where certain things were done and others were not attempted. Recently, when traditional roles have been challenged and introduction of more organized substantive content proposed, change has been resisted, because it runs counter to traditional child growth concepts and because harmful results were feared.

In relation to these objections, there needs to be considered the effect of changing conditions. New insights into the processes of child growth and development are constantly being discovered. The environment of children (and adults as well) is changing rapidly. Differences of opinion exist among specialists in the field and yet the positions of all specialists take into account marked variations or a high degree of flexibility in the patterns of child growth and development. In addition to these considerations, the present study has cast some doubt on possible harmful effects resulting from beginning the teaching of reading in the kindergarten.

Findings Concerning Possible Harmful Effects

The results of this investigation were most reassuring concerning potential harm which may result from early reading instruction. No evidence has been found which would substantiate such fears as have been expressed. The concern that the experimental early reading might produce visual defects has not been substantiated. Nor have any grounds been found to support the fear that organized beginning reading instruction in the kindergarten produced harmful social or psychological results. Instead, the evidence showed that the kindergarten beginning reading instruction was retained. Further, it had a measurable, positive continuing effect. The achievement of the children taught reading in the kindergarten, when built upon in succeeding grades, was significantly higher than that of their peers whose introduction to reading was delayed until the first grade. They were further ahead after five years than they would have been had reading been taught to them at the later traditional age.

Those who desire further evidence concerning this area, should be encouraged to conduct additional studies, for if the conclusions are viewed only as "straws in the wind" they are reassuring. The results suggest that other similar research can and should be carried on with much less trepidation about harming children. Undoubtedly, the potential dangers exist, but the experimental methodology used has shown that they can be avoided. The possible hazards should be kept in mind, but they do not constitute an excuse for opposing change or for justifying inaction. Little educational progress will be made if doubts and questions operate to prevent efforts to improve current practices.

This study has shown that with appropriate methods and materials of instruction beginning reading can be taught successfully in the kindergarten without harmful effects. To a great extent this is a confirmation of the fact that the mental age required for beginning to read is greatly influenced by the instructional methods and materials employed. Viewed in this way, it becomes as psychologists suggest, a matter of intent and a test of organizing skill.

A surprising and perhaps the most important aspect of the total study is the finding that most average youngsters in a large city public school system can profit from beginning to read in the kindergarten. It long has been recognized that some youngsters had learned to read before entering school. Generally, in this country it was thought that such attainment was possible only by precocious, gifted children having high socio-economic backgrounds--this, in spite of the fact that children in the British Isles begin to read at age five. Recent reports by Durkin [7] have also cast doubt upon this assumption. Many of her early readers came from blue-collar families, some having IQs as low as 91.

Somewhat similarly, the children in this study had a wide range of abilities and representative background found in large urban schools. Elaborate screening or readiness testing was not used. It was felt that the best screening device was the actual beginning reading instruction. Thus, all children were given the opportunity to begin to learn to read at an early age, and in varying degrees, most succeeded. The key seemed to be the opportunity--a chance to begin reading through appropriate, systematic, well-organized instruction.

OTHER SUPPORTING EVIDENCE

If appropriate environmental stimulation can nurture and spur the development of certain abilities, inappropriate conditions can delay their emergence. It has long been recognized that a general relationship exists between learning and environment. As Bruner has recently written, "It is not surprising in light of this that early opportunities for development have loomed so large in our recent understanding of human mental growth. The importance of early experience is only dimly sensed today. The experience from animal studies indicates that virtually irreversible deficits can be produced in mammals by depriving them of opportunities that challenge their nascent capacities." [8]

A similar conclusion, based upon research on both animals and humans, has been stated by Deutsch. [9] However, until recently, educators have not been fully aware of the exciting possibilities for nurturing intellectual growth through early educational stimulation.

Lately, there has been increasing support for the position that environmental stimuli can accelerate readiness. As Bruner has remarked, "The idea of readiness is a mischevious half-truth. It is a half-truth largely because it turns out that one teaches readiness or provides opportunities for its nurture; one does not simply wait for it. Readiness, in these terms, consists of mastery of those simple skills that permit one to teach higher skills. [10]

At present, many educational psychologists and theorists are exploring the effect of environment upon learning. They are striving to determine the extent to which early and continuous, structured stimulation of children increases learning of all kinds; cognitive, aesthetic, motor, and affective. Current research reports and contemporary articles in professional journals suggest numerous possibilities for increasing the performance level of children. Equally important, it seems likely that this worthwhile goal can be accomplished without harmful pressure. Indeed, it appears that children naturally welcome and respond to appropriate, stimulating challenges with which they can cope successfully.

The findings of this investigation also tend to support the desirability of a stimulating environment. They indicate that early sequentially structured stimulation results in high levels of symbolic learning. To the extent that this is so, school systems need to reexamine their kindergarten curriculum to determine its adequacy in line with emerging theory.

Other recent investigations support the findings of the Denver study. Moore [11] reports that after five years of teaching two, three, and four years olds to read, no signs of physical or psychological strain have been detected by pediatricians and psychologists.

Anderson found that children of varied mental abilities, as young as four years and four months benefited from early planned reading instruction. [12] McManus, [13] replicating a Denver study of the effectiveness of parents preparing their children for reading, [14] reaffirmed the value of parents helping their children learn to read at an early age. Hillerich, [15] describing a study involving the teaching of beginning reading skills found that children who were taught formal beginning reading in the kindergarten were better readers at the end of first grade than children who had not had such training.

Schoephoerster and others, [16] reporting a recent study, found that a formal readiness program including pupil's use of a workbook helped children of all ability levels more than did an informal readiness program without the pupil's use of workbooks. In regard to such kindergarten instruction creating frustration, emotional problems, or a permanent dislike for reading, he states that not one incident occurred or one piece of evidence appeared which would lend credence to such contentions.

Additional support for the position that early reading instruction does not cause visual defects is found in a recent report by Dr. Jules H. Shaw, head of the Eye Clinic at Beth Israel Hospital in Boston. He states that, "From a purely physical point of view, since most normal children can focus and accommodate at the age of twelve months, children's eyes are efficient enough for them to be taught to read at twelve months of age. . . If a child has normal eyes, is in good health, and has good intelligence, he can read at an early age." 17

Thus, the evidence from different sources suggests that early reading need not adversely affect children's vision. Obviously, any defects which may normally exist should be detected as quickly as possible and corrected so that optimum reading achievement is possible.

No doubt, the potential for good or evil is inherent in early reading instruction, as it is in most education. In the past, perhaps, too much attention has been directed to the potential dangers and too little to the many beneficial aspects which may result from early reading instruction. An extremely common sense position concerning early reading instruction is that taken by Durrell and Nicholson who point out "If child interest is one basis for planning preschool or kindergarten programs, it seems that early aspects of reading and writing should be included for some children. The fact that others may show little interest in these activities may be taken as a clue for extra effort. It is difficult to discover any peculiarity about early abilities related to reading and writing that excludes them from a developmental educational program. While there is objection to forcing the child in language activities, this objection applies equally to all phases of child development and it is assumed that a good teacher will apply only desirable motivations in all of them." 18

IMPLICATIONS

The implications seem clear. School systems need to re-evaluate the goals they have established for their kindergartens. Emerging psychological theory, recent research evidence, and the findings of the present study suggest that children profit from early educational stimulation. Children today appear to possess a greater aptitude for learning as a result of changes which have occurred in their environments. Improvements have been made in the methods and materials of instruction. It seems reasonable to suggest that school teachers and administrators should reconsider the role of the kindergarten.

The Denver study was limited to the development of beginning reading skills in the kindergarten. It is quite likely that other systems may prefer to explore the possibility of introducing other simple language, writing, science, or number skills to name but a few possibilities, or it may well be, that other school districts may wish to test other suitable beginning reading approaches in the kindergarten. It is entirely possible that through continuing exploration a better developmental program than that adopted for the purposes of the present study could be developed. Actually, the important task is to determine what is appropriate for kindergarten boys and girls in the conditions of today's world. This study was a pioneering venture in many ways. Much remains to be discovered. For example, what environmental conditions produce increased cognitive learning? How can the optimum time be determined for introducing these learnings to each child? What are the ways by which maximum reinforcement can be given to skills developed early in a child's school life?

On a very practical level, the awareness of what is possible--that some children may come to school reading and that others can be taught early--should lead every kindergarten teacher to differentiate her instruction so that each child may fully develop his aptitudes. The kindergarten teacher must feel free to teach beginning reading skills to some pupils and to delay systematic instruction for others. In this way, the extremes of reading or no reading can be avoided.

Obviously, no single kindergarten curriculum is suitable for all pupils. Generally, in the past, the practice has been to hold back those who might reasonably progress faster. A flexible kindergarten pattern is required which permits each pupil to achieve at his own rate.

Change has been occuring at a phenomenal rate in most areas of education. Presently, its influence is being felt in the kindergarten. School administrators have a responsibility to lead in the reappraisal of what constitutes appropriate kindergarten education. Their efforts may be aided by the findings of the present study and the use of other current research reports. Teachers, confused by conflicting opinions of those holding various positions, would do well to inaugurate informal research within their classrooms in order to determine what is possible with the boys and girls they teach. In this way, improvements in kindergarten education can be made; improvements which will preserve long, recognized values, while adding new dimensions required by the conditions of today's world. Through such efforts and through carefully planned research, the emerging role of the kindergarten may be defined.

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APPENDICES

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Appendix A.

TABLE I

PERCENTAGE OF CHILDREN IN EACH OF THE FOUR GROUPS READING THE INDICATED NUMBER OF BOOKS DURING THE SECOND GRADE

Number of Books Read	Group I	Group II	Group III	Group IV
0 - 19	39.6%	25.4%	40.7%	24.4%
20 - 40	29.4	27.6	25.8	30.0
41 - 61	13.2	18.6	17.3	19.9
More than 62	17.8	28.4	16.2	25.7
Total	100.0%	100.0%	100.0%	100.0%

The overall difference in percentages indicated is statistically significant beyond the .001 level of confidence, based upon the chi square test for differences in proportions.

TABLE II

PERCENTAGE OF CHILDREN IN EACH OF THE FOUR GROUPS READING THE INDICATED NUMBER OF BOOKS DURING THE THIRD GRADE

Number of Books Read	Group I	Group II	Group III	Group IV
0 - 40	54%	53%	68%	50%
41 - 82	32	36	24	31
More than 82	14	11	8	19
Total	100%	100%	100%	100%

The overall difference in percentages indicated is statistically significant beyond the .005 level of confidence, based upon the chi square test for differences in proportions.

TABLE III

PERCENTAGE OF CHILDREN IN EACH OF THE FOUR GROUPS READING THE INDICATED NUMBER OF BOOKS DURING THE FOURTH GRADE

Number of Books Read	Group I	Group II	Group III	Group IV
0 - 19	35%	22%	24%	21%
20 - 39	38	38	44	34
40 - 59	16	26	21	26
60 - 89	7	9	8	13
More than 89	4	5	3	6
Total	100%	100%	100%	100%

The overall difference in percentages indicated is statistically significant beyond the .001 level of confidence, based upon the chi square test for differences in proportions.

TABLE IV

PERCENTAGE OF CHILDREN IN EACH OF THE FOUR GROUPS READING THE INDICATED NUMBER OF BOOKS DURING THE FIRST SEMESTER OF FIFTH GRADE

Number of Books Read	Group I	Group II	Group III	Group IV
0 - 9	38%	30%	39%	33%
10 - 19	36	41	35	37
20 - 29	19	19	14	20
More than 29	7	10	12	10
Total	100%	100%	100%	100%

The overall difference in percentages indicated is not statistically significant.

Appendix B.

TABLE V

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-Oct. Test

One Dimensional Variance Analysis
The Independent Variable is Treatment

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	3	457.81	152.60	2.41	NS
Within Subgroups	2198	139431.70	63.44		

TABLE VI

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-Jan. Test

One Dimensional Variance Analysis
The Independent Variable is Treatment

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	3	5497.65	1832.55	16.05	< .001
Within Subgroups	2198	250990.25	114.19		

TABLE VII

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-Jan. Test

One Dimensional Covariance Analysis
The Independent Variable is Treatment
The Control Variable is K-Oct. Test

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS –	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	3	6827.24	2275.75	31.67	< .001
Within Subgroups	2197	157896.25	71.87		

TABLE VIII

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-Jan. Test

One Dimensional Variance Analysis
The Independent Variable is Treatment

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	5028.19	5028.19	43.99	< .001
Within Subgroups	2200	251459.19	5028.19		

TABLE IX

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-May Test

One Dimensional Variance Analysis
The Independent Variable is Treatment

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	3	49754.73	16584.91	104.14	< .001
Within Subgroups	2198	350050.54	159.26		

TABLE X

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-Oct. Test

One Dimensional Covariance Analysis
The Independent Variable is Treatment
The Control Variable is K-Oct. Test

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	3	54394.81	18131.60	156.77	< .001
Within Subgroups	2197	254106.54	115.66		

TABLE XI

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-May Test

One Dimensional Covariance Analysis
The Independent Variable is Treatment
The Control Variable is K-Jan. Test

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	3	26971.44	8990.48	106.79	< .001
Within Subgroups	2197	184954.54	84.19		

TABLE XII

TESTS FOR SIGNIFICANCE
GRADE Kindergarten
DEPENDENT VARIABLE K-Oct. Test

Two Dimensional Variance Analysis
The Independent Variables are Treatment x Sex

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	457.81	152.60	2.44	NS
Second Effect - Sex	1	1873.80	1873.80	29.93	< .001
Interaction-Treatment x Sex	3	179.68	59.90	0.96	NS
Within Subgroups	2194	137378.22	62.62		

TABLE XIII

TESTS FOR SIGNIFICANCE

GRADE Kindergarten
DEPENDENT VARIABLE K-Jan. Test

Two Dimensional Variance Analysis
The Independent Variables are Treatment x Sex

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	5497.65	1832.55	16.44	< .001
Second Effect - Sex	1	1982.56	1982.56	17.47	< .001
Interaction-Treatment x Sex	3	< 1	< 1	< 1	NS
Within Subgroups	2194	249041.29	113.51		

TABLE XIV

TESTS FOR SIGNIFICANCE

GRADE Kindergarten
DEPENDENT VARIABLE K-May Test

Two Dimensional Variance Analysis
The Independent Variables are Treatment x Sex

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	49754.73	16584.91	105.32	< .001
Second Effect- Sex	1	4451.42	4451.42	28.27	< .001
Interaction-Treatment x Sex	3	96.47	32.16	0.20	NS
Within Subgroups	2194	345502.65	157.48		

TABLE XV

TESTS FOR SIGNIFICANCE

GRADE Kindergarten
DEPENDENT VARIABLE K-Oct. Test

One Dimensional Variance Analysis
The Independent Variable is Age

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	2677.91	2677.91	42.94	< .001
Within Subgroups	2200	137211.60	62.37		

TABLE XVI

TESTS FOR SIGNIFICANCE

GRADE Kindergarten
DEPENDENT VARIABLE K-Jan. Test

One Dimensional Variance Analysis
The Independent Variable is Age

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	943.06	943.06	8.12	< .01
Within Subgroups	2200	255544.84	116.16		

TABLE XVII

TESTS FOR SIGNIFICANCE

GRADE Kindergarten
DEPENDENT VARIABLE K-Jan. Test

One Dimensional Covariance Analysis
The Independent Variable is Age
The Control Variable is K-Oct.

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	127.66	127.66	1.71	NS
Within Subgroups	2199	164595.84	74.85		

TABLE XVIII

TESTS FOR SIGNIFICANCE

GRADE Kindergarten
DEPENDENT VARIABLE K-May Test

One Dimensional Variance Analysis
The Independent Variable is Age

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	2154.40	2154.40	11.92	< .001
Within Subgroups	2200	397650.88	180.75		

TABLE XIX

TESTS FOR SIGNIFICANCE

GRADE Kindergarten

DEPENDENT VARIABLE K-May Test

One Dimensional Covariance Analysis
The Independent Variable is Age
The Control Variable is K-Oct. Test

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	21.47	21.47	0.15	NS
Within Subgroups	2199	308479.88	140.28		

TABLE XX

TESTS FOR SIGNIFICANCE

GRADE Kindergarten

DEPENDENT VARIABLE K-May Test

One Dimensional Covariance Analysis
The Independent Variable is Age
The Control Variable is K-Jan. Test

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
Between Groups	1	407.11	407.11	4.23	$< .05$
Within Subgroups	2199	211518.88	96.19		

TABLE XXI

TESTS FOR SIGNIFICANCE

GRADE One

DEPENDENT VARIABLE Gates Score - Total Reading

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, CA, MA

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	32215.26	10738.42	31.46	<.001
Second Effect- Sex	1	8671.99	8671.99	25.40	<.001
Interaction-Treatment x Sex	3	644.69	214.90	.63	NS
Within Subgroups	2048	699156.28	341.38		

TABLE XXII

TESTS FOR SIGNIFICANCE

GRADE Two

DEPENDENT VARIABLE Stanford - Total Reading

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Chronological Age, Mental Age

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	7546.77	2515.59	12.26	<.001
Second Effect- Sex	1	3203.32	3203.32	15.61	<.001
Interaction-Treatment x Sex	3	521.57	173.86	.85	NS
Within Subgroups	1686	345949.47	205.19		

TABLE XXIII

TESTS FOR SIGNIFICANCE

GRADE Two

DEPENDENT VARIABLE Paragraph Meaning

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	31682.78	1217.18	14.86	< .001
Second Effect- Sex	1	1439.58	1439.58	17.58	< .001
Interaction-Treatment x Sex	3	635.83	108.07	1.32	NS
Within Subgroups	1688	138264.89	81.91		

TABLE XXIV

TESTS FOR SIGNIFICANCE

GRADE Two

DEPENDENT VARIABLE Word Meaning

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	1619.46	539.82	11.97	< .001
Second Effect- Sex	1	628.12	628.12	13.93	< .01
Interaction-Treatment x Sex	3	145.17	48.39	1.07	NS
Within Subgroups	1688	76137.57	45.11		

TABLE XXV

TESTS FOR SIGNIFICANCE

GRADE Two

DEPENDENT VARIABLE Spelling

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	676.95	225.65	8.71	<.001
Second Effect- Sex	1	712.23	712.23	27.50	<.001
Interaction-Treatment x Sex	3	49.50	16.50	.64	NS
Within Subgroups	1687	43693.59	25.90		

TABLE XXVI

TESTS FOR SIGNIFICANCE

GRADE Two

DEPENDENT VARIABLE Arithmetic Reasoning

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	235.61	78.54	7.44	< .001
Second Effect- Sex	1	57.76	57.76	5.47	< .05
Interaction-Treatment x Sex	3	40.49	13.50	1.28	NS
Within Subgroups	1687	17812.14	10.56		

TABLE XXVII

TESTS FOR SIGNIFICANCE

GRADE Two

DEPENDENT VARIABLE Arithmetic Computation

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	373.54	124.52	3.25	< .05
Second Effect- Sex	1	206.29	206.29	5.39	< .05
Interaction-Treatment x Sex	3	0	0	0	NS
Within Subgroups	1687	64545.21	38.26		

TABLE XXVIII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Reading Comprehension

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	497.89	165.96	4.16	< .01
Second Effect- Sex	1	88.15	88.15	2.21	NS
Interaction-Treatment x Sex	3	84.06	26.02	< 1	NS
Within Subgroups	236	9414.74	39.89		

TABLE XXIX

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Reading Vocabulary

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	219.44	73.15	3.93	< .01
Second Effect- Sex	1	95.26	95.26	5.12	< .01
Interaction-Treatment x Sex	3	67.45	22.46	1.21	NS
Within Subgroups	236	4388.85	18.60		

TABLE XXX

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Letter Names

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	6.94	2.31	<1	NS
Second Effect- Sex	1	4.41	4.41	<1	NS
Interaction-Treatment x Sex	3	41.85	13.95	2.72	< .05
Within Subgroups	236	1208.84	5.12		

TABLE XXXI

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Auditory Discrimination

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	897.17	299.06	4.83	<.01
Second Effect- Sex	1	54.16	54.16	< 1	NS
Interaction-Treatment x Sex	3	367.21	122.40	1.98	NS
Within Subgroups	236	14603.46	61.88		

TABLE XXXII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Syllabication

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	11.98	3.99	< 1	NS
Second Effect- Sex	1	7.44	7.44	< 1	NS
Interaction-Treatment x Sex	3	41.46	13.82	1.04	NS
Within Subgroups	236	3140.29	13.31		

TABLE XXXIII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Beginning Sounds

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	19.35	6.45	1.54	NS
Second Effect- Sex	1	4.04	4.04	< 1	NS
Interaction-Treatment x Sex	3	15.38	5.13	1.22	NS
Within Subgroups	236	989.03	4.19		

TABLE XXXIV

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Ending Sounds

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	105.17	35.06	2.70	$< .05$
Second Effect- Sex	1	1.31	1.31	< 1	NS
Interaction-Treatment x Sex	3	9.61	3.20	< 1	NS
Within Subgroups	236	3070.77	13.01		

TABLE XXXV

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Blending

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	128.44	42.81	1.20	NS
Second Effect- Sex	1	13.55	13.55	< 1	NS
Interaction-Treatment x Sex	3	56.73	18.91	< 1	NS
Within Subgroups	236	8444.61	35.78		

TABLE XXXVI

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Sound Recognition

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	100.21	33.40	1.15	NS
Second Effect- Sex	1	25.27	25.27	< 1	NS
Interaction-Treatment x Sex	3	27.54	9.18	< 1	NS
Within Subgroups	236	6863.91	29.08		

TABLE XXXVII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Speed

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	383.44	127.81	4.16	< .01
Second Effect- Sex	1	60.71	60.71	1.97	NS
Interaction-Treatment x Sex	3	42.20	14.07	< 1	NS
Within Subgroups	1157	35586.04	30.76		

TABLE XXXVIII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Total Reading

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	26596.55	8865.52	59.30	< .001
Second Effect- Sex	1	100.93	100.93	< 1	NS
Interaction-Treatment x Sex	3	930.96	310.32	2.08	NS
Within Subgroups	1214	181504.53	149.51		

TABLE XXXIX

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Word Meaning

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	4089.65	136.22	58.81	$< .001$
Second Effect- Sex	1	1.99	1.99	< 1	NS
Interaction-Treatment x Sex	3	63.17	21.06	< 1	NS
Within Subgroups	1214	28143.50	23.18		

TABLE XL

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Paragraph Meaning

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	10485.57	3486.19	49.96	$< .001$
Second Effect- Sex	1	76.45	76.45	1.10	NS
Interaction-Treatment x Sex	3	563.40	187.80	2.69	$< .05$
Within Subgroups	1214	84714.32	69.78		

TABLE XLI

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Science & Social Studies Concepts

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	905.61	301.87	12.34	< .001
Second Effect- Sex	1	1367.96	1367.96	55.91	< .001
Interaction-Treatment x Sex	3	53.72	17.91	< 1	NS
Within Subgroups	1214	29704.67	24.47		

TABLE XLII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Spelling

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	202.12	67.37	2.15	NS
Second Effect- Sex	1	561.67	561.67	17.92	< .001
Interaction-Treatment x Sex	3	179.71	59.90	1.91	NS
Within Subgroups	1214	38047.26	31.34		

TABLE XLIII

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Word Study Skills

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	12171.16	4057.16	46.29	<.001
Second Effect - Sex	1	< 1	< 1	< 1	NS
Interaction-Treatment x Sex	3	388.07	129.36	1.48	NS
Within Subgroups	1220	106896.18	87.62		

TABLE XLIV

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Language

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	1844.94	614.98	8.34	<.001
Second Effect - Sex	1	189.58	189.58	2.57	NS
Interaction-Treatment x Sex'	3	111.32	37.11	< 1	NS
Within Subgroups	1220	89998.11	73.77		

TABLE XLV

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Arithmetic Computation

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS	Degrees of Freedom	Sums of Squares	Mean Square	F Ration	P
First Effect - Treatment	3	2856.85	952.28	8.42	<.001
Second Effect - Sex	1	386.34	386.34	3.42	NS
Interaction-Treatment x Sex	3	268.56	89.52	<1	NS
Within Subgroups	1220	137937.93	113.06		

TABLE XLVI

TESTS FOR SIGNIFICANCE

GRADE Three

DEPENDENT VARIABLE Arithmetic Concepts

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	1276.00	425.33	8.86	<.001
Second Effect - Sex	1	2407.75	2407.75	50.17	<.001
Interaction-Treatment x Sex	3	70.90	23.63	<1	NS
Within Subgroups	1220	58549.72	47.99		

TABLE XLVII

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Total Reading

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	77996.63	25998.88	137.02	<.001
Second Effect - Sex	1	209.40	209.40	1.10	NS
Interaction-Treatment x Sex	3	234.93	78.31	0.41	NS
Within Subgroups	1252	237553.16	189.74		

TABLE XLVIII

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Word Meaning

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	18371.10	6123.70	182.12	<.001
Second Effect - Sex	1	88.98	88.98	2.65	NS
Interaction-Treatment x Sex	3	14.90	4.97	9.15	<.001
Within Subgroups	1252	42097.91	33.63		

TABLE XLIX

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Paragraph Meaning

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	22006.71	7335.57	90.22	< .001
Second Effect - Sex	1	71.79	71.97	0.88	NS
Interaction-Treatment x Sex	3	208.20	69.40	0.85	NS
Within Subgroups	1252	101802.77	81.31		

TABLE L

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Spelling

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	113.01	37.67	0.50	NS
Second Effect - Sex	1	1948.59	1948.59	25.64	< .001
Interaction-Treatment x Sex	3	341.39	113.80	1.50	NS
Within Subgroups	1252	95133.53	75.99		

TABLE LI

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Word Study Skills

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	16112.60	5370.87	61.43	< .001
Second Effect - Sex	1	656.57	656.57	7.51	< .01
Interaction-Treatment x Sex	3	1027.19	342.40	3.92	< .01
Within Subgroups	1252	109461.76	87.43		

TABLE LII

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Language

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	857.88	285.96	1.81	NS
Second Effect - Sex	1	1824.30	1824.30	11.53	< .001
Interaction-Treatment x Sex	3	484.71	161.57	1.02	NS
Within Subgroups	1252	198119.72	158.24		

TABLE LIII

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Arithmetic Computation

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	618.11	206.04	4.39	$<.01$
Second Effect - Sex	1	138.71	138.71	2.96	NS
Interaction-Treatment x Sex	3	562.01	187.34	3.99	$<.01$
Within Subgroups	1252	58740.21	46.92		

TABLE LIV

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Arithmetic Concepts

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	293.87	97.96	3.19	$<.05$
Second Effect - Sex	1	1147.09	1147.09	37.40	$<.001$
Interaction-Treatment x Sex	3	257.89	85.96	2.80	$<.05$
Within Subgroups	1252	38403.24	30.67		

TABLE LV

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Arithmetic Application

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	292.76	97.59	3.08	<.05
Second Effect - Sex	1	1617.84	1617.84	50.99	<.001
Interaction-Treatment x Sex	3	37.37	12.46	0.39	NS
Within Subgroups	1252	39727.37	31.73		

TABLE LVI

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Social Studies

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	504.87	168.29	3.58	<.05
Second Effect - Sex	1	1533.51	1533.51	32.58	<.001
Interaction-Treatment x Sex	3	<1	<1	<1	NS
Within Subgroups	1252	58939.30	47.08		

TABLE LVII

TESTS FOR SIGNIFICANCE

GRADE Four

DEPENDENT VARIABLE Science

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variables are IQ, Occupation

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	564.30	188.10	3.14	< .05
Second Effect - Sex	1	1610.77	1610.77	26.85	< .001
Interaction-Treatment x Sex	3	< 1	< 1	< 1	NS
Within Subgroups	1252	75101.04	59.99		

TABLE LVIII

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Total Reading

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	126227.181	42075.727	218.910	< .001
Second Effect - Sex	1	622.176	622.176	3.237	NS
Interaction-Treatment x Sex	3	< 1	< 1	< 1	NS
Within Subgroups	2481	476862.189	192.206		

TABLE LIX

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Paragraph Meaning

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ration	P
First Effect - Treatment	3	29255.039	9751.680	133.775	.001
Second Effect - Sex	1	27.704	27.704	0.380	NS
Interaction-Treatment x Sex	3	189.795	63.265	0.868	NS
Within Subgroups	2177	158694.471	72.896		

TABLE LX

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Word Meaning

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	24461.707	8153.902	191.161	<.001
Second Effect - Sex	1	570.828	570.828	13.383	<.001
Interaction-Treatment x Sex	3	<1	<1	<1	NS
Within Subgroups	2177	92859.221	42.655		

TABLE LXI

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Social Studies

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	38135.630	12711.877	192.482	< .001
Second Effect - Sex	1	3940.989	3940.989	59.674	< .001
Interaction-Treatment x Sex	3	< 1	< 1	< 1	NS
Within Subgroups	2185	144301.220	66.042		

TABLE LXII

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Arithmetic Application

Two Dimensional Covariance Analysis
The Independent Variables are Treatment x Sex
The Control Variable is IQ

TESTS FOR SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	181.366	60.455	2.347	NS
Second Effect - Sex	1	1408.336	1408.336	54.686	< .001
Interaction-Treatment x Sex	3	< 1	< 1	< 1	NS
Within Subgroups	2145	55240.354	25.753		

TABLE LXIII

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Arithmetic Concept

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	270.117	90.039	4.681	<.01
Second Effect - Sex	1	1197.379	1197.379	62.254	<.001
Interaction-Treatment x Sex	3	22.987	7.662	0.398	NS
Within Subgroups	2145	41256.334	19.234		

TABLE LXIV

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Arithmetic Computation

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	296.778	98.926	4.937	<.05
Second Effect - Sex	1	219.464	219.464	10.952	<.01
Interaction-Treatment x Sex	3	46.998	15.666	0.782	NS
Within Subgroups	2145	42981.533	20.038		

TABLE LXV

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Language

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	57119.768	19039.923	114.167	<.001
Second Effect - Sex	1	3197.761	3197.761	19.174	<.001
Interaction-Treatment x Sex	3	1172.634	390.878	2.344	NS
Within Subgroups	2204	367565.131	166.772		

TABLE LXVI

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Science

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	939.724	313.241	5.529	<.01
Second Effect - Sex	1	2621.015	2621.015	46.264	<.001
Interaction-Treatment x Sex	3	< 1	< 1	< 1	NS
Within Subgroups	2193	124241.388	56.654		

TABLE LXVII

TESTS FOR SIGNIFICANCE

GRADE Five

DEPENDENT VARIABLE Spelling

Two Dimensional Covariance Analysis

The Independent Variables are Treatment x Sex

The Control Variable is IQ

TESTS OF SIGNIFICANCE FOR ALL SOURCES OF VARIATION

RESIDUALS -	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	P
First Effect - Treatment	3	102.465	34.155	0.522	NS
Second Effect - Sex	1	4901.750	4901.750	74.895	<.001
Interaction-Treatment x Sex	3	129.703	43.234	0.661	NS
Within Subgroups	2197	143790.475	65.449		